

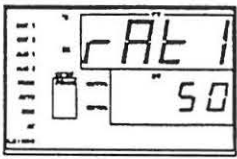
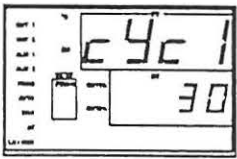
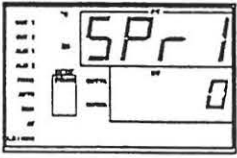
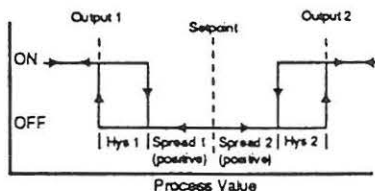
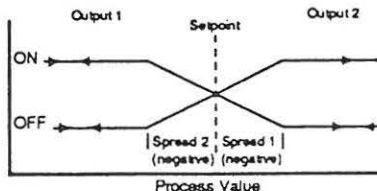
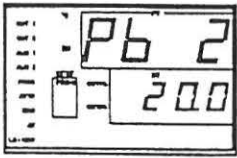
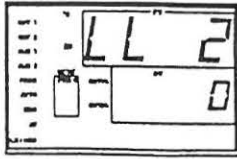
Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtU	SEc	SYs	LP	CEL	AE	tun1	tun2	in	ALr

7.6 Tuning Set 1 & 2 Setup

Display	Key	Description
		From the Operating mode, press and release the Setup key. Press the Setup key repeatedly until the header screen for either Tuning Set 1 or Tuning Set 2 appears. Note that Tuning Set 1 and Tuning Set 2 contain identical functions and so just Tuning Set 1 is illustrated here.
 Or		Tuning Set 1 includes setpoint 1, proportional band for output 1, load line for output 1, reset for output 1, rate for output 1, cycle time for output 1, spread for output 1, proportional band for output 2, load line for output 2, reset for output 2, rate for output 2, cycle time for output 2, and spread for output 2. Note that Tuning Set 2 includes a set of functions identical to those above. Press the Function key to bring up the Setpoint 1 screen.
 Or	 	7.6.1 Setpoint 1 (or 2) The Setpoint 1 setting determines the process control setting that will be used with Tuning Set 1. The Setpoint 2 setting determines the process control setting that will be used with Tuning Set 2. The default setting is zero (or the Setpoint Low Limit if zero is outside of the low limit). The range is from the Setpoint Low Limit to the Setpoint High Limit. The entry is made in engineering units (refer to Input Setup) to the precision determined by the decimal location (refer also to Input Setup). Note that this setting can also be changed from the Operating mode (refer to the Operating mode). Press the Function key to bring up the Proportional Band 1 screen.
	 	7.6.2 Proportional Band 1 The Proportional Band 1 setting determines the percentage of the input scale in which a switching Output 1 will time proportion its output. Control Algorithm 1 must be "Pid" or "Pd-r" in order for this setting to appear. "10.0" (% of input scale) is the default setting. The range is from 0.0% to 200.0% of the input scale (Input Scale High - Input Scale Low). Press the Function key to bring up the Load Line 1 screen.
	 	7.6.3 Load Line 1 The Load Line 1 setting adjusts the percent of Output 1 at which the controller will reach setpoint. The Load Line 1 setting also serves as the "manual reset" term if Control Algorithm 1 has been set to "Pd-r." Control Algorithm 1 must be either "Pid" or "Pd-r" in order for this setting to appear. "50" (percent of PB) is the default setting. The range of the setting is from 0% to 100%. <i>Note that autotuning with a Pid algorithm sets the load line to zero (autotuning with a Pd-r algorithm will NOT cause load line to change).</i> Press the Function key to bring up the Reset 1 screen.
	 	7.6.4 Reset 1 The Reset 1 setting (integral) determines the time interval in which Control Output 1 will attempt to reduce its error signal to zero. Control Algorithm 1 must be "Pid" for this screen to appear. Note that Reset 1 will have no effect until the controller is within the Output 1 proportional band. "200" (seconds) is the default setting. The range is from zero to 3600 (seconds). Press the Function key to bring up the Rate 1 screen.

Setup									
5E6	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
5E6	555	LP	CEL	AE	Auto 1	Auto 2	in	ALr	

Tuning Set 1 & 2 Setup (continued)

Display	Key	Description
	  	7.6.5 Rate 1 The Rate 1 setting (derivative) determines how much earlier the controller begins adjusting its Output 1 based on the slope (rate of change) of the error signal. Control Algorithm 1 must be either "Pid" or "Pd-r" in order for this setting to appear. "50" (seconds) is the default setting. The range is from zero to 2400 (seconds). Press the Function key to bring up the Cycle Time 1 screen.
	  	7.6.6 Cycle Time 1 The Cycle Time 1 setting determines the length of time of one full cycle (on-time + off-time) of a switching Output 1. Control Algorithm 1 must be either "Pid" or "Pd-r" in order for this setting to appear. In addition, Output 1 must be a switching type (relay, voltage for SSR, or Triac – refer to Output Configuration). "30" (seconds) is the default setting. The range is from one to 120 (seconds). Note that 30 seconds is the minimum setting for relays. Press the Function key to bring up the Spread 1 screen.
	  	7.6.7 Spread 1 The Spread 1 setting determines the amount of offset from setpoint of control action of Output 1. Zero (engineering units) is the default setting. The range is $\pm 10\%$ of the input scale (Input Scale High - Input Scale Low). For Spread 1, if the setting is positive, it is subtracted from setpoint. If the setting is negative, it is added to setpoint (setpoint is overlapped).   Press the Function key to bring up the Proportional Band 2 screen.
	  	7.6.8 Proportional Band 2 The Proportional Band 2 setting determines the percentage of the input scale in which a switching Output 2 will time proportion its output. Control Algorithm 2 must be "Pid" or "Pd-r" in order for this setting to appear. The controller must also be equipped with a second output. "20.0" (% of input scale) is the default setting. The range is from 0.0% to 200.0% of the input scale (Input Scale High - Input Scale Low). Press the Function key to bring up the Load Line 2 screen.
	  	7.6.9 Load Line 2 The Load Line 2 setting adjusts the percent of Output 2 at which the controller will reach setpoint. The Load Line 2 setting also serves as the "manual reset" term if Control Algorithm 2 has been set to "Pd-r." Control Algorithm 2 must be either "Pid" or "Pd-r" in order for this setting to appear. The controller must also be equipped with a second output. "0" (percent of PB) is the default setting. The range of the setting is from 0% to 100%. <i>Note that autotuning with a Pid algorithm sets the load line to zero (autotuning with a Pd-r algorithm will NOT cause load line to change).</i> Press the Function key to bring up the Reset 2 screen.

Setup									
SEtU	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEc	SYS	LP	CEL	AE	tun1	tun2	in	Alr	

Tuning Set 1 & 2 Setup (continued)

Display	Key	Description
	 	7.6.10 Reset 2 The Reset 2 setting (integral) determines the time interval in which Control Output 2 will attempt to reduce its error signal to zero. Control Algorithm 2 must be "Pid" for this screen to appear. Note that Reset 2 will have no effect until the controller is within the Output 2 proportional band. "200" (seconds) is the default setting. The range is from zero to 3600 (seconds). Press the Function key to bring up the Rate 2 screen.
	 	7.6.11 Rate 2 The Rate 2 setting (derivative) determines how much earlier the controller begins adjusting its Output 2 based on the slope (rate of change) of the error signal. Control Algorithm 2 must be either "Pid" or "Pd-r" in order for this setting to appear. "50" (seconds) is the default setting. The range is from zero to 2400 (seconds). Press the Function key to bring up the Cycle Time 2 screen.
	 	7.6.12 Cycle Time 2 The Cycle Time 2 setting determines the length of time of one full cycle (on-time + off-time) of a switching Output 2. Control Algorithm 2 must be either "Pid" or "Pd-r" in order for this setting to appear. In addition, Output 2 must be a switching type (relay, voltage for SSR, or Triac – refer Output Configuration). "30" (seconds) is the default setting. The range is from 1 to 120 (seconds). Note that 30 seconds is the minimum setting for relays. Press the Function key to bring up the Spread 2 screen.
	 	7.6.12 Spread 2 The Spread 2 setting determines the amount of offset from setpoint of control action of Output 2. Zero (engineering units) is the default setting. The range is $\pm 10\%$ of the input scale (Input Scale High - Input Scale Low). For Spread 2, if the setting is positive, it is added to setpoint. If the setting is negative, it is subtracted from setpoint (setpoint is overlapped). Press the Function key to bring up the Tuning Set 1 Header screen.
	 	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.

Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtU	SEc	SYS	LP	CEL	AE	tun1	tun2	in	ALr

7.7 Input Setup

Display	Key	Description
		From the Operating mode, press and release the Setup key. Press the Setup key repeatedly until the Input Setup Header screen appears.
		The Input Setup settings include input type (a "read only" screen), engineering units, input correction, input filter, and decimal setting. Press the Function key to bring up the Slot 5 Input Type screen.
	 	7.7.1 Slot 5 Input Type Note that this is a READ ONLY screen. The input type is actually selected in Input Configuration. This screen is included for reference to assist with the other entries needed for input setup (see Table 7.1 below). Press the Function key to bring up the Engineering Units 5 (Slot 5) screen.

t c t	Type K,	-100 °F to 2400 °F -75 °C to 1320 °C
t c J	Type J,	-100 °F to 1600 °F -75 °C to 875 °C
t c P	PL-II,	0 °F to 2500 °F -20 °C to 1375 °C
t c E	Type E,	-100 °F to 1600 °F -75 °C to 875 °C
t c c	Type C,	0 °F to 4200 °F -20 °C to 2320 °C
t c nn	Ni/Ni Mo,	32 °F to 2500 °F 0 °C to 1371 °C
t c t	Type T,	-350 °F to 700 °F -215 °C to 375 °C
t c S	Type S,	0 °F to 3100 °F -20 °C to 1705 °C

t c r	Type R,	0 °F to 3100 °F -20 °C to 1705 °C
t c b	Type B,	100 °F to 3100 °F 37 °C to 1817 °C
t c n	Type N,	-100 °F to 2400 °F -75 °C to 1320 °C
L n n U	mVDC,	-1999 to 9999 (unitless)
L n n A	mADC,	-1999 to 9999 (unitless)
L U d c	VDC,	-1999 to 9999 (unitless)
(option) P l t B	RTD,	-199.9 °F to 999.9 °F -199.9 °C to 850.0 °C

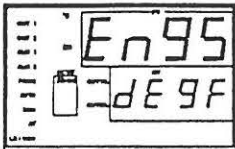
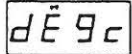
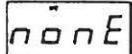
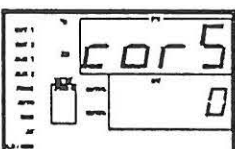
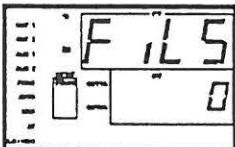
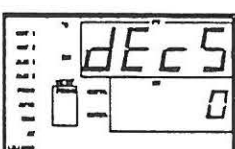
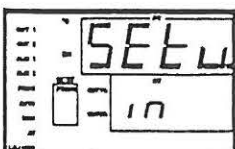
Note that RTDs and all thermocouple types (except Type T) can have their decimal point programmed up to one place. Volt, millivolt, and milliamp inputs can have as many as 3 decimal places, depending on their scale limits (see Decimal Setting).

Accuracy not guaranteed for Type B below 200°C or for Types R and S below 100°C.

Table 7.1 Input Types

Setup									
SEtU	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEc	SYS	LP	CEL	AE	tun1	tun2	in	ALr	

Input Setup (continued)

Display	Key	Description										
  	  	7.7.2 Slot 5 Engineering Units The Slot 5 Engineering Units setting determines the units used by the Slot 5 input. "dEG F" (Fahrenheit) is the default setting. "dEG C" (Celsius) or "nonE" for unitless are the other two choices. Press the Function key to bring up the Slot 5 Sensor Correction screen.										
	  	7.7.3 Slot 5 Sensor Correction The Slot 5 Sensor Correction setting determines the amount of "offset" (in engineering units) applied to the input in Slot 5. Zero is the default setting. The range is $\pm 5\%$ of the input scale (Input Scale High - Input Scale Low). Press the Function key to bring up the Slot 5 Filter Window screen.										
	  	7.7.4 Slot 5 Filter Window The Slot 5 Filter Window setting determines the length of time (in seconds) that is used to average input readings from the sensor in Slot 5. Any input reading within the filter window will be averaged to generate the process value. Zero is the default setting. The range is from zero to 10 (seconds). Note that this setting is used to help overcome possible noise on the input. Note also that using a filter window setting will slow the response of the controller. Press the Function key to bring up the Slot 5 Decimal screen.										
 1 place  2 places  3 places 	  	7.7.5 Slot 5 Decimal Setting The Slot 5 Decimal setting determines the location of the decimal point on both the Process Value display (the big LEDs) and the Setpoint Variable display (the small LEDs). Zero (none) is the default setting. The range is determined by the Input Scale Limits (see Input Configuration) as follows: <table><thead><tr><th>Input Scale Limits</th><th>Decimal Range</th></tr></thead><tbody><tr><td>from -1.999 to 9.999</td><td>0 to 3</td></tr><tr><td>from -19.99 to 99.99</td><td>0 to 2</td></tr><tr><td>from -199.9 to 999.9</td><td>0 to 1</td></tr><tr><td>from -1999 to 9999</td><td>0</td></tr></tbody></table> Note that an Input type change may force an automatic change in the number of decimal places displayed. Press the Function key to bring up the Input Setup Header screen.	Input Scale Limits	Decimal Range	from -1.999 to 9.999	0 to 3	from -19.99 to 99.99	0 to 2	from -199.9 to 999.9	0 to 1	from -1999 to 9999	0
Input Scale Limits	Decimal Range											
from -1.999 to 9.999	0 to 3											
from -19.99 to 99.99	0 to 2											
from -199.9 to 999.9	0 to 1											
from -1999 to 9999	0											
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.										

Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEt u	SEc	SYS	LP	CEL	AE	Tun 1	Tun 2	in	ALr

7.8 Alarm Setup

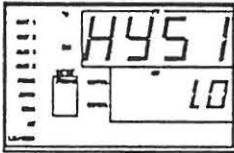
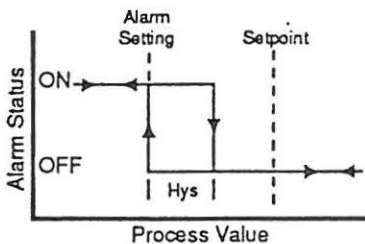
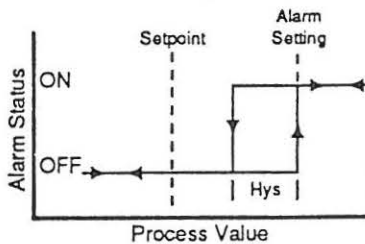
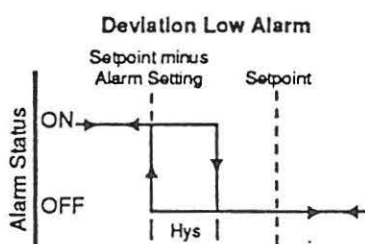
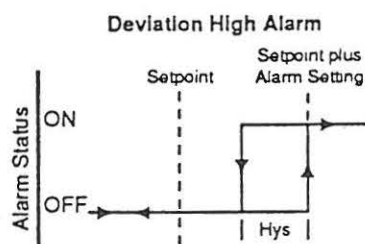
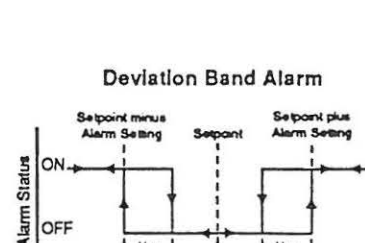
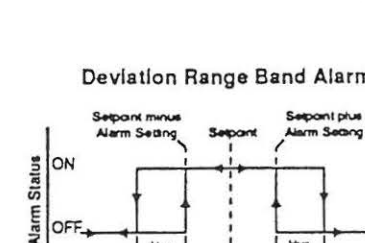
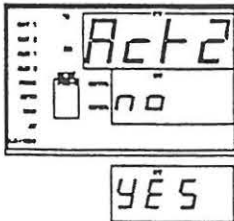
Display	Key	Description
		From the Operating mode, press and release the Setup key. Press the Setup key repeatedly until the Alarm Setup Header screen appears.
		The Alarm Settings include Alarm 1 acknowledge, Alarm 1 setpoint, Alarm 1 hysteresis, Alarm 2 acknowledge, Alarm 2 setpoint, Alarm 2 hysteresis, and a Loop Break setting. Press the Function key to bring up the Alarm 1 Acknowledge screen.
	 	7.8.1 Alarm 1 Acknowledge The Alarm 1 Acknowledge screen is used to acknowledge Alarm 1 occurrences. The screen will always appear with "no" displayed. Toggle the display to "yes" to acknowledge Alarm 1. See Table 7.2 below for the results of acknowledging different types of alarms. Press the Function key to bring up the Alarm 1 Setpoint screen.
	 	7.8.2 Alarm 1 Setpoint The Alarm 1 Setpoint screen is used to enter the Alarm 1 setpoint. The controller must be equipped with Alarm 1 (optional) and the Alarm 1 type (see Alarm Configuration) must be either process or deviation in order for this setting to appear. Zero is the default setting. The range for process alarms is from Input Scale Low to Input Scale High. The range for deviation alarms is 0 to 9999 (based on decimal location). Press the Function key to bring up the Alarm 1 Hysteresis screen.

Alarm Occurs LED flashing Relay Energized	Latching	Alarm condition still exists	Acknowledged	LED lit steady Relay energized
			Not Acknowledged	LED flashing Relay energized
		Alarm condition clears	Acknowledged	LED off Relay deenergized
			Not Acknowledged	LED flashing Relay energized
	Non-Latching	Alarm condition still exists	Acknowledged	LED lit steady Relay deenergized
			Not Acknowledged	LED flashing Relay energized
		Alarm condition clears		LED off Relay deenergized

Table 7.2 Alarm Acknowledgement Scheme

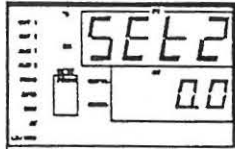
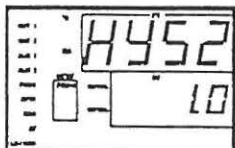
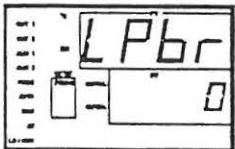
Setup									
SEtU	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEt	SYs	LP	CEL	AE	tun1	tun2	in	ALr	

Alarm Setup (continued)

Display	Key	Description
	  	7.8.3 Alarm 1 Hysteresis The Alarm 1 Hysteresis setting determines the hysteresis applied to Alarm 1. The controller must be equipped with Alarm 1 (optional) and the Alarm 1 type (see Alarm Configuration) must be either process or deviation in order for this setting to appear. Zero is the default setting. The range is 10% of the Input Scale (see Input Configuration). Process Low Alarm  Process High Alarm  Deviation Low Alarm  Deviation High Alarm  Deviation Band Alarm  Deviation Range Band Alarm 
		Press the Function key to bring up the Alarm 2 Acknowledge screen.
		7.8.4 Alarm 2 Acknowledge The Alarm 2 Acknowledge screen is used to acknowledge Alarm 2 occurrences. The screen will always appear with "no" displayed. Toggle the display to "yes" to acknowledge Alarm 2. See Table 7.2 for the results of acknowledging different types of alarms. Press the Function key to bring up the Alarm 2 Set screen.
	  	

Setup									
SEt	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEt	SEC	SYS	LP	CEL	AE	tun1	tun2	in	ALr

Alarm Setup (continued)

Display	Key	Description
	  	7.8.5 Alarm 2 Setpoint The Alarm 2 Setpoint screen is used to enter the Alarm 2 setpoint. The controller must be equipped with Alarm 2 (optional) and the Alarm 2 type (see Alarm Configuration) must be either process or deviation in order for this setting to appear. Zero is the default setting. The range for process alarms is from Input Scale Low to Input Scale High. The range for deviation alarms is 0 to 9999 (based on decimal location). Press the Function key to bring up the Alarm 2 Hysteresis screen.
	  	7.8.6 Alarm 2 Hysteresis The Alarm 2 Hysteresis setting determines the hysteresis applied to Alarm 2. The controller must be equipped with Alarm 2 (optional) and the Alarm 2 type (see Alarm Configuration) must be either process or deviation in order for this setting to appear. Zero is the default setting. The range is 10% of the Input Scale (see Input Configuration). Refer to Alarm 1 Hysteresis. Press the Function key to bring up the Loop Break Setting screen.
	  	7.8.7 Loop Break Setting The Loop Break Setting determines the amount of time (in minutes) that must pass without progress toward setpoint (the output demand must also be at maximum) before a loop break alarm occurs. Zero is the default setting (zero disables the function). The range is from zero to 10 (minutes). Note that the loop break alarm is always available as an annunciator LED and may be assigned to an alarm output (see Alarm Configuration). Note that loop break alarms do NOT have an effect on the control process. Press the Function key to bring up the Alarm Setup Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.

8. The Configuration Mode

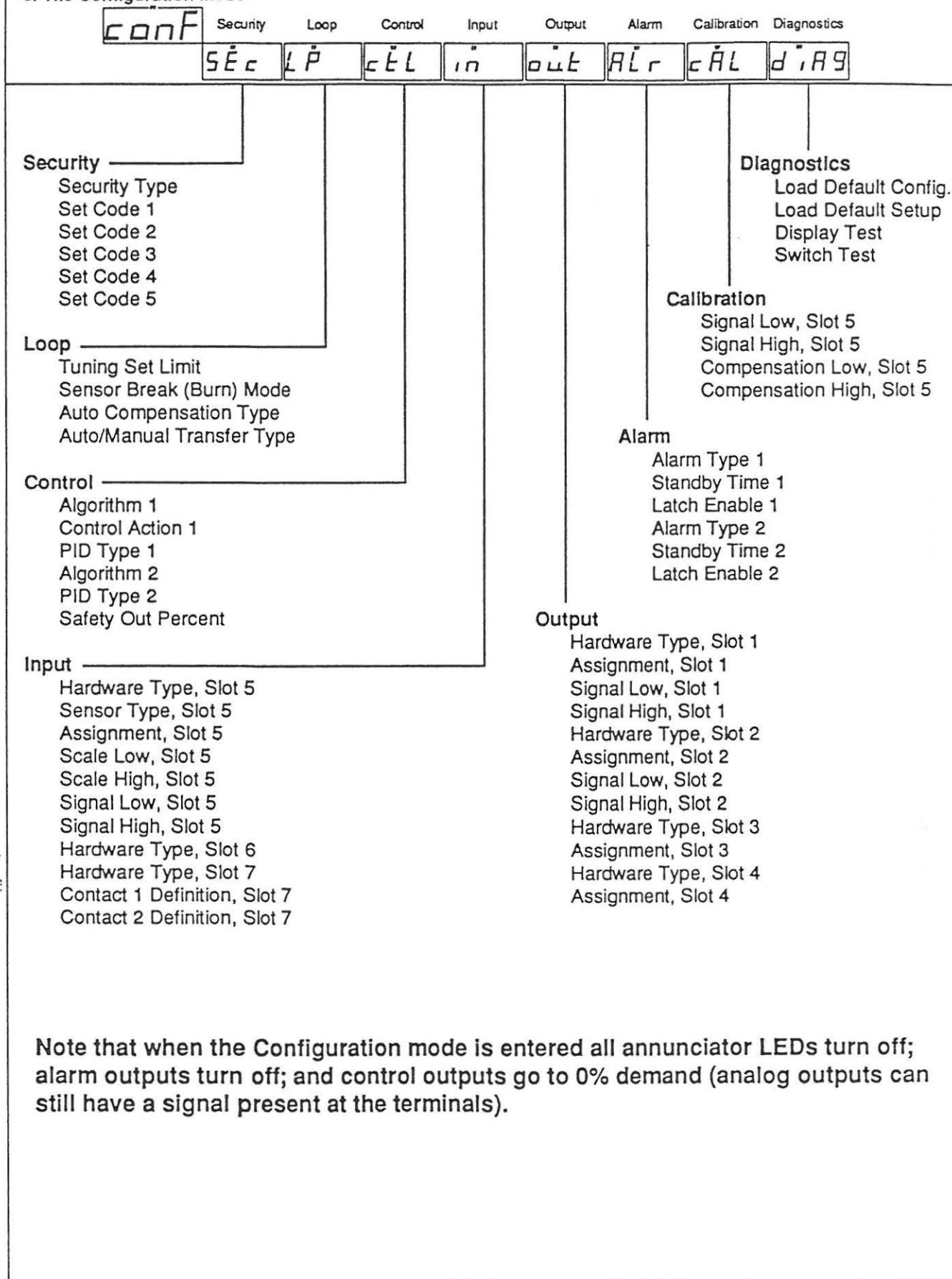


Figure 8.1 The Configuration Loop

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
SEc	LP	CEL	in	out	ALr	CAL	dIAG	

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

8.1 Security Configuration

Display	Key	Description
		From the Operating mode, press and hold (for 4 seconds) the Setup key and the Security Configuration Header screen will appear.
		Security Configuration is used to enable or disable the software security function, as well as to institute or change passwords to be used with each of the five possible security levels. Press the Function key to bring up the Security Type screen.
	 	8.1.1 Security Type The Security Type setting determines whether or not the software security function is enabled. "nonE" is the default setting. With "nonE" selected, the software security function is disabled, and, provided there is no hardware security (optional), all Setup and Configuration parameters will be available to the user. "PASS" is the only other setting. With "PASS" selected, the software security function is enabled and the security level will be determined by passcode entry (see below and the Operating mode). Press the Function key to bring up the Set Code 1 screen.
	 	8.1.2 Set Code 1 - 5 The Set Code 1 through Set Code 5 screens are used to determine the security code necessary in order to operate at a particular security level. The default passcode for Security Level 1 is "1"; The default passcode for Security Level 2 is "2"; etc. The range of the passcodes is from zero to 9999. If identical codes are used for two or more levels, the first time the code is entered the controller will go to the lowest level for that code. If the same code is entered again (from that level), the controller will go to the next level that uses that code...etc. (note that doing this successively can cause the controller to "wrap around" to the lower security level). Press the Function key to bring up the next Code screen. Repeat this procedure for all five Code levels. If the codes are changed, make certain to WRITE down the codes and store a copy of them in a secure place! Note that when the Configuration mode is exited, the controller will set itself to Security Level 1 (go to Security Setup and enter the passcode for the security level at which it is desired to operate). Press the Function key to bring up the Security Configuration Header screen.
	 	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
SEc	LP	CEL	in	out	ALr	CAL	diag	

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

8.2 Loop Configuration

Display	Key	Description
		From the Operating mode, press and hold (for 4 seconds) the Setup key. Press the Setup key a second time and the Loop Configuration Header screen will appear.
		Loop Configuration is used to determine the tuning set enable setting, the sensor break response and the auto-compensation type. Press the Function key to bring up the Tuning Set Limit screen.
	 	8.2.1 Tuning Set Limit The Tuning Set Limit screen determines how many tuning sets can be accessed when using the Setpoint Select key. "1-2" is the default setting. The range is from "1" to "1-2." With "1-2" selected, both Tuning Set 1 and Tuning Set 2 are accessible from the Operating mode (depending on Setpoint Source and Setpoint Select Enable – see Loop Setup). A Tuning Set includes a control setpoint and a full set of tuning constants (depending on the output type and algorithm). Refer to Tune 1 Setup or Tune 2 Setup. Press the Function key to bring up the Sensor Break (Burn) Mode screen.
	 	8.2.2 Sensor Break (Burn) Mode The Sensor Break mode screen determines the response of the controller to a sensor break. Note that Sensor Break functions ONLY with a thermocouple or RTD input. The settings are: uP Causes outputs to go to the "off" condition (0% demand for PID outputs; "Off" for On/Off outputs). Alarms go to an upscale reading. This is the default setting. dwn Causes outputs to go to the "off" condition (0% demand for PID outputs; "Off" for On/Off outputs). Alarms go to a downscale reading. SAFu Causes outputs to go to the Safety Out demand percent specified by the user (see Control Config.). Alarms go to an upscale reading. SAFd Causes outputs to go to the Safety Out demand percent specified by the user (see Control Config.). Alarms go to a downscale reading. Atcu Causes the controller to use the auto-compensation setting (see below). Alarms go to an upscale reading. Atcd Causes the controller to use the auto-compensation setting (see below). Alarms go to a downscale reading. Press the Function key to bring up the Auto-Compensation type screen.

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEC

LP

CEL

in

out

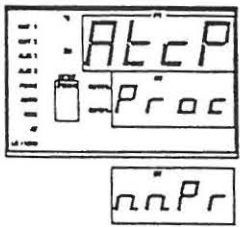
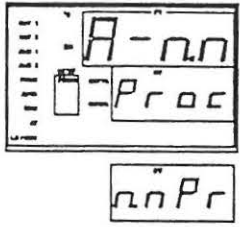
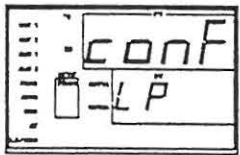
ALr

CAL

diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

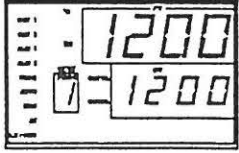
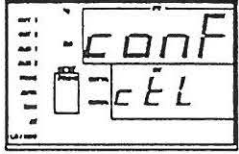
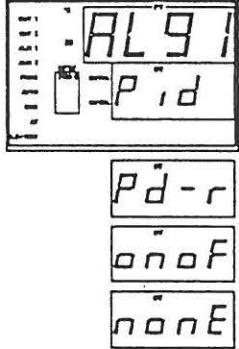
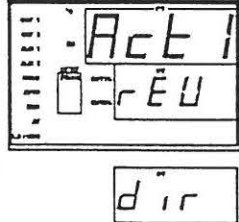
Loop Configuration (continued)

Display	Key	Description
	  	8.2.3 Auto-Compensation Type The Auto-Compensation type setting determines the response of the controller if auto-compensation becomes active. "Process" is the default setting. Choosing "process" causes the outputs to freeze at the present demand percent if the "steady state" conditions have been met. If "process" is chosen but the "steady state" conditions have not been met, the Manual Percent Preset Out setting will be used. Choosing "manual percent" causes the outputs to go to the Manual Percent Preset Out setting specified by the user (see Control Setup). Press the Function key to bring up the Auto/Manual Transfer Type screen.
	  	8.2.4 Auto/Manual Transfer Type The Auto/Manual Transfer Type setting determines the type of transfer that will occur if the Manual Mode is selected using the Contact Input function. In order for this display to appear, both the Auto/Manual Select option and the Contact Input option must be present. "Process" is the default setting. Choosing "process" will cause the controller to use the present output demand if switched to manual by contact input. Choosing "manual percent" will cause the controller to use the Manual Percent Preset Out setting (see Control Setup) if switched to manual by contact input. Press the Function key to bring up the Loop Configuration Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEC	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

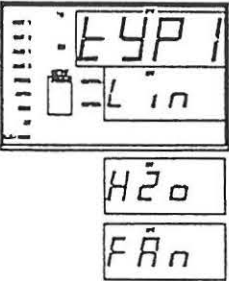
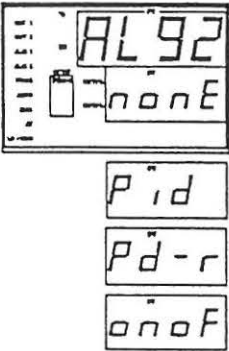
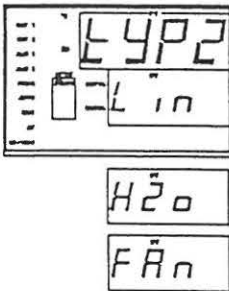
8.3 Control Configuration

Display	Key	Description
		From the Operating mode, press and hold (for 4 seconds) the Setup key. Press the Setup key twice and the Control Configuration Header screen will appear.
		Control Configuration is used to determine the control algorithm, the control action (reverse or direct) and PID type (linear, water or fan). Press the Function key to bring up the Algorithm 1 screen.
	  	8.3.1 Algorithm 1 The Algorithm 1 setting determines the control algorithm used by Control Output 1 ("ctl 1" – see Output Configuration). "Pid" is the default setting for Algorithm 1. Choosing "Pid" causes Output 1 to operate as a 3-mode (Proportional, Integral and Derivative) output with a "load line" setting. Choosing "Pd-r" causes Output 1 to operate as a 2-mode (Proportional and Derivative) output with a manual reset (load line) setting. Choosing "onof" causes Output 1 to operate as an On/Off output (note that Output 1 must be a switching output – either relay or pulse voltage or triac – see Output Configuration). Choosing "nonE" causes Output 1 to NOT be used. Note that "nonE" cannot be chosen for Algorithm 1 unless Algorithm 2 has been previously set to "nonE" also. Note that choosing "nonE" for both Algorithm 1 and Algorithm 2 will cause the controller to act as an indicator only (the Process Value will appear in the upper display and the lower display will remain blank). Press the Function key to bring up the Control Action 1 screen.
	  	8.3.2 Control Action 1 The Control Action 1 setting determines how the demand signal is applied to Control Output 1. This screen will not appear if Algorithm 1 is set to "nonE." "Reverse" is the default setting. Choosing "reverse" causes Control Output 1 to be reverse acting and Control Output 2 (if present) to be direct acting. Using proportional control (Pid or Pd-r) with a REVERSE acting Output 1 causes the percent demand to decrease as the process value rises towards setpoint. Using On/Off control with a REVERSE acting Output 1 causes the output to turn off if the process value is above setpoint. Using proportional control (Pid or Pd-r) with a DIRECT acting Output 1 causes the percent demand to increase as the process value rises towards setpoint. Using On/Off control with a DIRECT acting Output 1 causes the output to turn on if the process value is above setpoint. Press the Function key to bring up the PID Type 1 screen.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEc	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

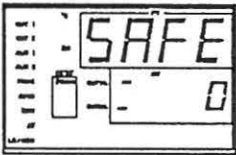
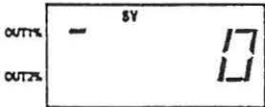
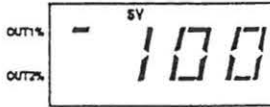
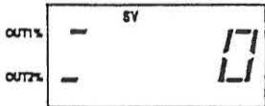
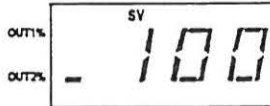
Control Configuration (continued)

Display	Key	Description
	  	8.3.3 PID Type 1 The PID Type 1 setting determines how the results of the control algorithm are applied to a DIRECT acting Control Output 1. This screen will not appear unless Control Action 1 is "direct." "Linear" is the default setting. Choosing "linear" causes the percent demand calculated by the control algorithm to be applied without modification. Choosing "H2O" (water) causes the percent demand calculated by the control algorithm to be squared. Choosing "fan" causes the percent demand calculated by the control algorithm to be constrained by the minimum and maximum power settings (refer to Control Setup). Note that choosing "fan" will cause the values for minimum and maximum power to be set to their defaults (20% minimum; 100% maximum). Press the Function key to bring up the Algorithm 2 screen.
	  	8.3.4 Algorithm 2 The Algorithm 2 setting determines the control algorithm used by Control Output 2 ("ctl 2" – see Output Configuration). The controller must be equipped with an (optional) Output 2 in order for this setting to appear. "nonE" is the default setting. Choosing "nonE" causes Output 2 to NOT be used. Choosing "Pid" causes Output 2 to operate as a 3-mode (Proportional, Integral and Derivative) output with a "load line" setting. Choosing "Pd-r" causes Output 2 to operate as a 2-mode (Proportional and Derivative) output with a manual reset (load line) setting. Choosing "onof" causes Output 2 to operate as an On/Off output (note that Output 2 must be a switching output – either relay or pulse voltage or triac – see Output Configuration). Note that choosing "nonE" for both Algorithm 1 and Algorithm 2 will cause the controller to act as an indicator only (the Process Value will appear in the upper display and the lower display will remain blank). Press the Function key to bring up the PID Type 2 screen.
	  	8.3.5 PID Type 2 The PID Type 2 setting determines how the results of the control algorithm are applied to a DIRECT acting Control Output 2. The controller must be equipped with an (optional) Output 2 in order for this setting to appear. This setting will not appear unless the Control Output 2 action is "direct" (meaning that the Control Action for Output 1 has been set to "reverse." "Linear" is the default setting. Choosing "linear" causes the percent demand calculated by the control algorithm to be applied without modification. Choosing "H2O" (water) causes the percent demand calculated by the control algorithm to be squared. Choosing "fan" causes the percent demand calculated by the control algorithm to be constrained by the minimum and maximum power settings (refer to Control Setup). Note that choosing "fan" will cause the values for minimum and maximum power to be set to their defaults (20% minimum; 100% maximum). Press the Function key to bring up the Safety Percent Out screen.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEC	LP	CEL	IN	OUT	ALR	CAL	DAG

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Control Configuration (continued)

Display	Key	Description
	  	8.3.6 Safety Out Percent The Safety Percent Out setting determines the percent output used by the controller if it should enter the "halt" mode. This can occur if the "halt" function is executed by contact closure (option); or a sensor break occurs and the sensor break action ("burn" type) has been set to "safe" (see Loop Configuration). The default setting is 0%. The range for a controller with a single output is 0% to 100% (105% for analog outputs). The range for a controller with two outputs is from 100% Output 1 to 100% Output 2 (105% for analog outputs).  0% Out, Single Output  100% Out, Output 1  0% Out, Dual Output  100% Out, Output 2 Press the Function key to bring up the Control Configuration Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.

Configuration

conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
5E5	LP	CEL	in	out	ALr	CAL	d:AG	

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

8.4 Input Configuration

Display	Key	Description
		From the Operating mode, press and hold (for 4 seconds) the Setup key. Press the Setup key repeatedly until the Input Configuration Header screen appears.
		Input Configuration is used to determine the hardware type, the sensor type, low scale setting, high scale setting, low signal setting, high signal setting and contact input definitions. Press the Function key to bring up the Slot 5 Hardware Type screen.
	 	8.4.1 Slot 5 Hardware Type The Slot 5 Hardware Type screen is a "read only" screen whose display is determined by the hardware located in Slot 5 (Terminals 37, 38 and 39) of the controller. "Universal" is the only hardware presently available for Slot 5. "Universal" indicates that thermocouple types, RTDs, as well as current, voltage and millivoltage types can be used in Slot 5. Press the Function key to bring up the Slot 5 Sensor Type screen.
	 	8.4.2 Slot 5 Sensor Type The Slot 5 Sensor Type setting determines the sensor used for Slot 5. Changing sensor type will cause the controller to automatically enter the default Input Scale Low and Input Scale High settings for the chosen sensor. Changing the sensor type causes the controller to recalculate a variety of scales (a "Unit Busy" screen appears). Make certain to check both the setup and configuration if the sensor type is changed. Note that the units used for scaling will depend on the Engineering Units setting (see Input Setup). "Deg F" or "Deg C" will be used if that is the setting. "Deg F" will also be used for "none." Refer to the Table below. Press the Function key to bring up the Slot 5 Assignment screen.

Type K, -100 °F to 2400 °F -75 °C to 1320 °C	Type R, 0 °F to 3100 °F -20 °C to 1705 °C
Type J, -100 °F to 1600 °F -75 °C to 875 °C	Type B, 100 °F to 3100 °F 37 °C to 1817 °C
PL-II, 0 °F to 2500 °F -20 °C to 1375 °C	Type N, -100 °F to 2400 °F -75 °C to 1320 °C
Type E, -100 °F to 1600 °F -75 °C to 875 °C	mVDC, -1999 to 9999 (unitless)
Type C, 0 °F to 4200 °F -20 °C to 2320 °C	mADC, -1999 to 9999 (unitless)
Ni/Ni Mo, 32 °F to 2500 °F 0 °C to 1371 °C	VDC, -1999 to 9999 (unitless)
Type T, -350 °F to 700 °F -215 °C to 375 °C	(option) RTD, -199.9 °F to 999.9 °F -199.9 °C to 850.0 °C
Type S, 0 °F to 3100 °F -20 °C to 1705 °C	

Note that RTDs and all thermocouple types (except Type T) can have their decimal point programmed up to one place. Volt, millivolt, and millamp inputs can have as many as 3 decimal places, depending on their scale limits (see Decimal Setting).

Accuracy not guaranteed for Type B below 200°C or for Types R and S below 100°C.

Table 8.1 Input Types

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEC

LP

CEL

IN

OUT

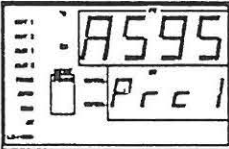
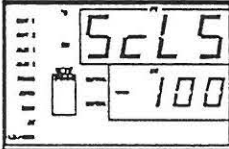
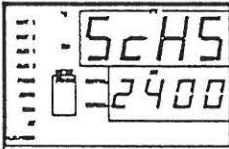
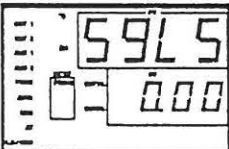
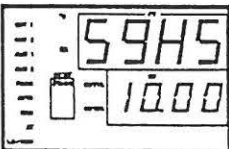
ALR

CAL

DIAG

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Input Configuration (continued)

Display	Key	Description
	  	8.4.3 Slot 5 Assignment The Slot 5 Assignment screen is a "read only" screen whose display is determined by the hardware located in Slot 5 (Terminals 37, 38 and 39) of the controller. "Process 1" is the only assignment presently available for Slot 5. Press the Function key to bring up the Slot 5 Input Scale Low screen.
	  	8.4.4 Slot 5 Input Scale Low The Slot 5 Input Scale Low setting determines the low scale of the sensor type used in Slot 5. The default setting is determined by the sensor type. The range is from the default setting up to the Slot 5 Input Scale High setting. For linear inputs (current, volts or millivolts), input scale low can be set anywhere from -1999 up to the input scale high setting (depending on decimal location). Press the Function key to bring up the Slot 5 Input Scale High screen.
	  	8.4.5 Slot 5 Input Scale High The Slot 5 Input Scale High setting determines the high scale of sensor type used in Slot 5. The default setting is determined by the sensor type. The range is from the default setting down to the Slot 5 Input Scale Low setting. For linear inputs (current, volts or millivolts), input scale high can be set anywhere from 9999 down to the input scale low setting (depending on decimal location). Press the Function key to bring up the Slot 5 Signal Low screen.
 (millivolts) -100 (milliamps) 000 (volts) 000	  	8.4.6 Slot 5 Input Signal Low The Slot 5 Input Signal Low setting determines the low input signal for Slot 5. This screen appears only if the input type is volts, millivolts or milliamps. This setting corresponds directly to the Input Scale Low setting for conversion into engineering units. The default setting for volts and current is "0.00" (volts and milliamps). The default setting for millivolts is "-10.0" (millivolts). Note that if the controller is ordered with a current, volt or millivolt input in the model number, it will be supplied with that particular Input Signal Low setting. The range is from the default setting up to the Slot 5 Input Signal High setting. Press the Function key to bring up the Slot 5 Signal High screen.
 (millivolts) 1000 (milliamps) 2000 (volts) 1000	  	8.4.7 Slot 5 Input Signal High The Slot 5 Input Signal High setting determines the high input signal for Slot 5. This screen appears only if the input type is volts, millivolts or milliamps. This setting corresponds directly to the Input Scale High setting for conversion into engineering units. The default setting for volts is "10.00" (volts). The default setting for current is "20.00" (milliamps). The default setting for millivolts is "100.0" (millivolts). Note that if the controller is ordered with a current, volt or millivolt input in the model number, it will be supplied with that particular Input Signal High setting. The range is from the default setting down to the Slot 5 Input Signal Low setting. Press the Function key to bring up the Slot 6 Hardware Type screen.

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEC

LP

CEL

in

out

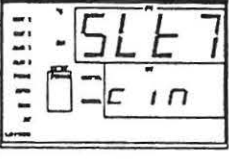
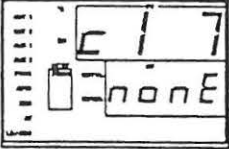
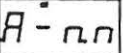
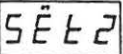
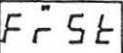
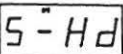
ALr

CAL

DAG

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

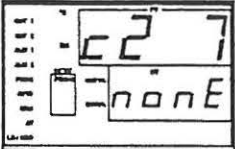
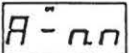
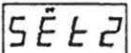
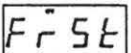
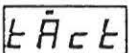
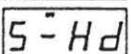
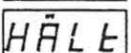
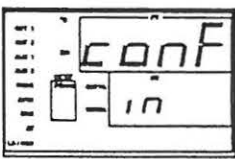
Input Configuration (continued)

Display	Key	Description
	  	8.4.8 Slot 6 Hardware Type The Slot 6 Hardware Type screen is a "read only" screen whose display is determined by the hardware located in Slot 6 (Terminals 34, 35 and 36) of the controller. There is no hardware presently available for Slot 6. Press the Function key to bring up the Slot 7 Hardware Type screen.
(option) 	  	8.4.9 Slot 7 Hardware Type The Slot 7 Hardware Type screen is a "read only" screen whose display is determined by the hardware located in Slot 7 (Terminals 31, 32 and 33) of the controller. "Contact In" is the only hardware presently available for Slot 7. "Contact In" indicates the optional contact input hardware is present in Slot 7. Press the Function key to bring up the Slot 7 Contact 1 Definition screen.
      	  	8.4.10 Slot 7 Contact 1 Definition The Slot 7 Contact 1 Definition screen determines which of the optional contact closure functions is assigned to Contact 1 (Terminals 31 and 33). "none" is the default setting. The range of settings is as follows: "A-m" Controller will switch to manual control (Auto/Manual Select option must be present) as long as contacts are closed. The controller will use either the present process percent out or the "manual percent preset" based on the Auto/Manual Transfer Type (see Loop Configuration). Note that as long as the contact is closed, the Auto/Manual key will NOT function and the percent out can NOT be changed from the keypad. "SEt 2" Controller will switch to Tuning Set 2 as long as contacts are closed. Note that as long as the contact is closed, the Setpoint Source key will NOT function and the Setpoint Select variable cannot be changed. "FrSt" Controller will stop calculating (freeze) the reset term and use current value for control as long as contacts are closed. "tAct" Controller will toggle the control action from whatever the control action was to the opposite control action as long as contacts are closed. "S-Hd" Controller will use the present process value for control (sample and hold) as long as contacts are closed. "HALt" Controller will use the Safety Percent Out setting (see Control Configuration) as long as contacts are closed. Note that On/Off outputs will be converted to time proportioning using the Safety Percent Out setting and Cycle Time (default cycle time is 30 seconds – see Tuning Set 1 & 2 Setup). Press the Function key to bring up the Slot 7 Contact 2 Definition screen.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEC	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

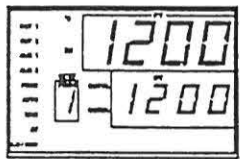
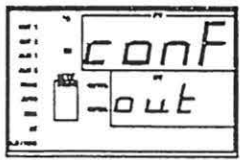
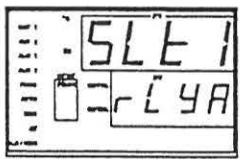
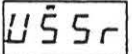
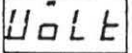
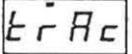
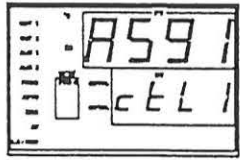
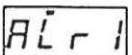
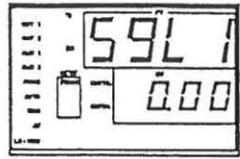
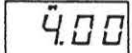
Input Configuration (continued)

Display	Key	Description
      	  	8.4.11 Slot 7 Contact 2 The Slot 7 Contact 2 Definition screen determines which of the optional contact closure functions is assigned to Contact 2 (Terminals 32 and 33). "nonE" is the default setting. The range of settings is as follows: "A-m" Controller will switch to manual control (Auto/Manual Select option must be present) as long as contacts are closed. The controller will use either the present process percent out or the "manual percent preset" based on the Auto/Manual Transfer Type (see Loop Configuration). Note that as long as the contact is closed, the Auto/Manual key will NOT function and the percent out can NOT be changed from the keypad. "SEt 2" Controller will switch to Tuning Set 2 as long as contacts are closed. Note that as long as the contact is closed, the Setpoint Source key will NOT function and the Setpoint Select variable cannot be changed. "FrSt" Controller will stop calculating (freeze) the reset term and use current value for control as long as contacts are closed. "tAct" Controller will toggle the control action from whatever the control action was to the opposite control action as long as contacts are closed. "S-Hd" Controller will use the present process value for control (sample and hold) as long as the contacts are closed. "HALt" Controller will use the Safety Percent Out setting (see Control Configuration) as long as contacts are closed. Note that On/Off outputs will be converted to time proportioning using the Safety Percent Out setting and Cycle Time (default cycle time is 30 seconds – see Tuning Set 1 & 2 Setup). Press the Function key to bring up the Input Configuration Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
S $\bar{E}$ c	L $\bar{P}$	c $\bar{E}$ L	i $\bar{n}$	o $\bar{u}$ t	A $\bar{L}$ r	c $\bar{A}$ L	d $\bar{I}$ A $\bar{G}$	

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

8.5 Output Configuration

Display	Key	Description
		From the Operating mode, press and hold (for 4 seconds) the Setup key. Press the Setup key repeatedly until the Output Header screen appears.
		Output Configuration is determined by the hardware present in the controller. Note that most of the screens included in Output Configuration are "read only" and cannot be changed from the keypad. Press the Function key to bring up the Slot 1 Hardware Type screen.
     		8.5.1 Slot 1 Hardware Type The Slot 1 Hardware screen displays the type of hardware installed in Slot 1 (Terminals 9 and 10 – see the wiring label). Note that this is a "read only" screen. The possible hardware types are: "rLY A" (Form A Relay) "VSSr" Pulse Non-Contact Voltage for Solid State Relay (12VDC) "curr" Current (4 to 20 mADC as ordered) "VoLt" Voltage (0 to 10 VDC as ordered) "trAc" Triac (24 to 260 VAC, 1A) "nonE" No hardware installed in Slot 1 Press the Function key to bring up the Slot 1 Assignment screen.
 		8.5.2 Slot 1 Assignment The Slot 1 Assignment screen displays the function of the hardware type installed in Slot 1 (Terminals 9 and 10). Note that this is a "read only" screen. The possible functions are: "ctL 1" Control Output 1 "ALr 1" Alarm 1 Press the Function key to bring up the Slot 1 Output Signal Low screen.
 	  	8.5.3 Slot 1 Output Signal Low The Slot 1 Output Signal Low setting determines the lowest analog signal available for the control output of Assignment 1 (Control Output 1). This setting corresponds to zero percent demand. This screen will appear only if the hardware type in Slot 1 is current or voltage. The default setting is 4.00 (mADC) or 0.00 (VDC). The range is from 0.00 (mADC or VDC) to Slot 1 Output Signal High. Press the Function key to bring up the Slot 1 Output Signal High screen.

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEc

LP

CEL

in

out

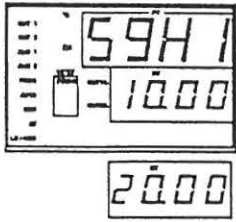
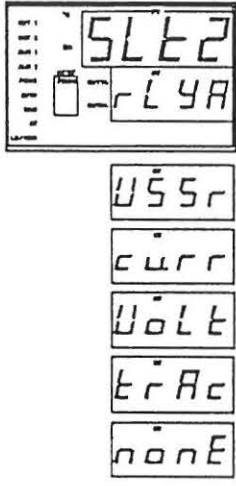
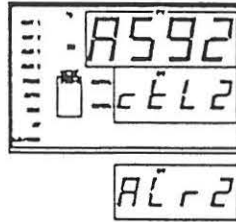
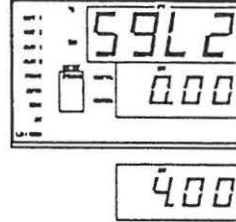
ALr

CAL

diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Output Configuration (continued)

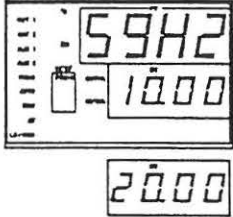
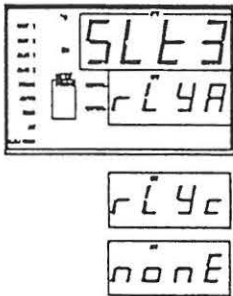
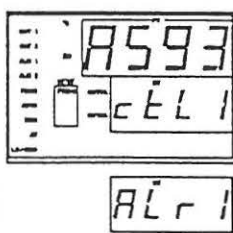
Display	Key	Description
	  	8.5.4 Slot 1 Output Signal High The Slot 1 Output Signal High setting determines the highest analog signal available for the control output of Assignment 1 (Control Output 1). This setting corresponds to 100 percent demand. This screen will appear only if the hardware type in Slot 1 is current or voltage. The default setting is 20.00 (mADC) or 10.00 (VDC). The range is from Slot 1 Output Signal Low (mADC or VDC) to 20.00 (mADC) or 10.00 (VDC). Press the Function key to bring up the Slot 2 Hardware Type screen.
		8.5.5 Slot 2 Hardware Type The Slot 2 Hardware Type screen displays the type of hardware installed in Slot 2 (Terminals 7 and 8 – see the wiring label). Note that this is a "read only" screen. The possible hardware types are: "rLY A" (Form A Relay) "VSSr" Pulse Non-Contact Voltage for Solid State Relay (12VDC) "curr" Current (4 to 20 mADC as ordered) "Volt" Voltage (0 to 10 VDC as ordered) "trAc" Triac (24 to 260 VAC, 1A) "nonE" No hardware installed in Slot 2 Press the Function key to bring up the Slot 2 Assignment screen.
		8.5.6 Slot 2 Assignment The Slot 2 Assignment screen displays the function of the hardware type installed in Slot 2 (Terminals 7 and 8). Note that this is a "read only" screen. The possible functions are: "ctL 2" Control Output 2 "ALr 2" Alarm 2 Press the Function key to bring up the Slot 2 Output Signal Low screen.
	  	8.5.7 Slot 2 Output Signal Low The Slot 2 Output Signal Low setting determines the lowest analog signal available for the control output of Assignment 2 (Control Output 2). This setting corresponds to zero percent demand. This screen will appear only if the hardware type in Slot 2 is current or voltage. The default setting is 4.00 (mADC) or 0.00 (VDC). The range is from 0.00 (mADC or VDC) to Slot 2 Output Signal High. Press the Function key to bring up the Slot 2 Output SignalHigh screen.

Configuration

conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
S _E c	L _P	c _T L	i _n	o _u t	ALr	c _{AL}	d _i AG	

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

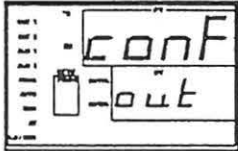
Output Configuration (continued)

Display	Key	Description
	  	8.5.8 Slot 2 Output Signal High The Slot 2 Output Signal High setting determines the highest analog signal available for the control output of Assignment 2 (Control Output 2). This setting corresponds to 100 percent demand. This screen will appear only if the hardware type in Slot 2 is current or voltage. The default setting is 20.00 (mADC) or 10.00 (VDC). The range is from Slot 2 Output Signal Low (mADC or VDC) to 20.00 (mADC) or 10.00 (VDC). Press the Function key to bring up the Slot 3 Hardware Type screen.
		8.5.9 Slot 3 Hardware Type The Slot 3 Hardware Type screen displays the type of hardware installed in Slot 3 (Terminals 5 and 6 or 4, 5 and 6 – see the wiring label). Note that this is a "read only" screen. The possible hardware types are: "rLY A" (Form A Relay) "rLY C" (Form C Relay) (uses Terminals 4, 5 and 6). Note that the Slot 4 Hardware screen will not appear. "nonE" No hardware installed in Slot 3 Press the Function key to bring up the Slot 3 Assignment screen.
		8.5.10 Slot 3 Assignment The Slot 3 Assignment screen displays the function of the hardware type installed in Slot 3 (Terminals 5 and 6 or 4, 5 and 6). Note that this is a "read only" screen. The possible functions are: "ctL 1" Control Output 1 (Terminals 4, 5 and 6) "ALr 1" Alarm 1 (Terminals 5 and 6) Press the Function key to bring up the Slot 4 Hardware Type screen.
		8.5.11 Slot 4 Hardware Type The Slot 4 Hardware Type screen displays the type of hardware installed in Slot 4 (Terminals 4 and 5 – see the wiring label). Note that this is a "read only" screen. The possible hardware types are: "rLY A" (Form A Relay) "nonE" No hardware installed in Slot 3 Press the Function key to bring up the Slot 4 Assignment screen.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEc	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Output Configuration (continued)

Display	Key	Description
		8.5.12 Slot 4 Assignment The Slot 4 Assignment screen displays the function of the hardware type installed in Slot 4 (Terminals 4 and 5). Note that this is a "read only" screen. The only possible function is: "ALr 2" Alarm 2 (Terminals 4 and 5) Press the Function key to bring up the Output Configuration Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.

PRELIMINARY

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEC

LP

CEL

IN

OUT

ALr

CAL

DIAG

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

8.6 Alarm Configuration

Display	Key	Description
		From the Operating mode, press and hold (for 4 seconds) the Setup key. Press the Setup key repeatedly until the Alarm Configuration Header screen appears.
		Alarm Configuration is used to determine the type, standby setting and latching ability of any alarms present in the controller. Press the Function key to bring up the Alarm 1 Type screen.
 	 	8.6.1 Alarm 1 Type The Alarm 1 Type setting determines the alarm conditions for Alarm 1. The possible settings are: "nonE" No alarm function "dVHi" Deviation high alarm "dVLo" Deviation low alarm "dVbd" Deviation band alarm "drbd" Deviation range band alarm "PrHi" Process high alarm "PrLo" Process low alarm "LPbr" Loop break alarm Deviation High Alarm Deviation Low Alarm Deviation Band Alarm Deviation Range Band Alarm

(continued)

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEC

LP

CEL

in

out

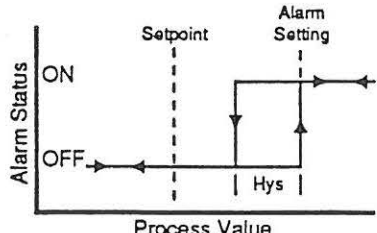
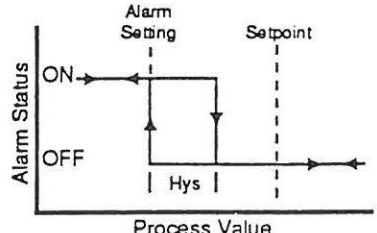
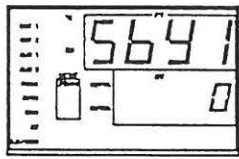
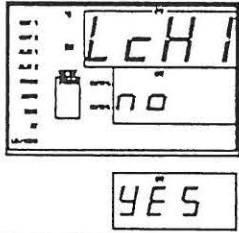
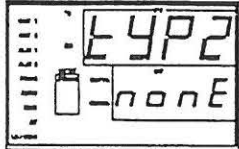
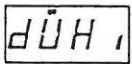
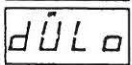
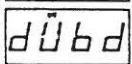
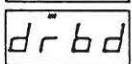
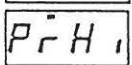
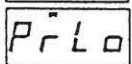
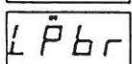
ALr

CAL

diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

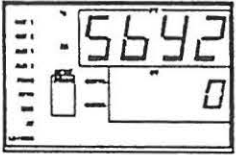
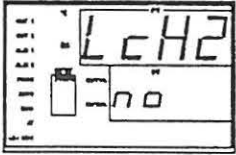
Alarm Configuration (continued)

Display	Key	Description
	  	Process High Alarm  Process Low Alarm  Note that a Loop Break Alarm will occur if demand is at maximum ("On" for On/Off control) and no progress is made towards setpoint within the time period entered in the Loop Break Setting (see Alarm Setup). Press the Function key to bring up the Alarm 1 Standby Time Screen.
	  	8.6.2 Alarm 1 Standby Time The Alarm 1 Standby Time setting determines the length of time after powerup that a first alarm condition will be ignored. If the process should come out of the alarm condition and then re-enter the alarm condition BEFORE the standby setting expires, the alarm will activate. Zero (minutes) is the default setting. The range is from zero to 100 (minutes). Press the Function key to bring up the Alarm 1 Latch Enable screen.
	  	8.6.3 Alarm 1 Latch Enable The Alarm 1 Latch Enable setting determines whether or not the alarm relay will be deenergized when the alarm is acknowledged. "No" is the default setting. Choosing "no" will cause Alarm 1 to operate so as to deenergize when acknowledged. Choosing "yes" will cause Alarm 1 to operate so as to remain energized even when acknowledged. Press the Function key to bring up the Alarm 2 Type screen.
          		8.6.4 Alarm 2 Type The Alarm 2 Type setting determines the alarm conditions for Alarm 2 (see Alarm 1 above). The possible settings are: "nonE" No alarm function "dVHi" Deviation high alarm "dVLo" Deviation low alarm "dVbd" Deviation band alarm "drbd" Deviation range band alarm "PrHi" Process high alarm "PrLo" Process low alarm "LPbr" Loop break alarm Press the Function key to bring up the Alarm 2 Standby Time Screen.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEC	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Alarm Configuration (continued)

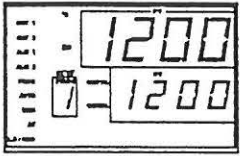
Display	Key	Description
	  	8.6.5 Alarm 2 Standby Time The Alarm 2 Standby Time setting determines the length of time after powerup that a first alarm condition will be ignored. If the process should come out of the alarm condition and then re-enter the alarm condition BEFORE the standby setting expires, the alarm will activate. Zero (minutes) is the default setting. The range is from zero to 100 (minutes). Press the Function key to bring up the Alarm 2 Latch Enable screen.
	  	8.6.6 Alarm 2 Latch Enable The Alarm 2 Latch Enable setting determines whether or not the alarm relay will be deenergized when the alarm is acknowledged. "No" is the default setting. Choosing "no" will cause Alarm 2 to operate so as to deenergize when acknowledged. Choosing "yes" will cause Alarm 2 to operate so as to remain energized even when acknowledged. Press the Function key to bring up the Alarm Configuration Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.

1261-IN-002-0-00

Configuration							
conf	Security	Loop	Control	Input	Output	Alarm	Calibration Diagnostics
	SEC	LP	CEL	in	out	ALr	CAL d:AG

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

8.7 Calibration

Display	Key	Description
		Note that this controller comes from the factory fully calibrated. Under normal operating conditions, recalibration should not be necessary. Calibration should, however, be checked periodically. An accurate temperature compensated Volt, millivolt, and milliamp source, as well as a precision resistor box will be required in order to perform a field calibration. A complete calibration procedure requires a zero and span input for each of the six different input types (volts, millivolts, milliamps, RTD, and two separate thermocouple types). Before beginning the calibration procedure, make certain the input is set to the type being calibrated (see Input Configuration). For Zero and Span (Signal Low and Signal High), connect the source (or resistor) to the controller as shown in Figure 8.2 below. From the Operating mode, press and hold (for 4 seconds) the Setup key. Press the Setup key repeatedly until the Calibration Header screen appears.

Connect to Terminals as shown below for Zero (Input Signal Low) and Span (Input Signal High).

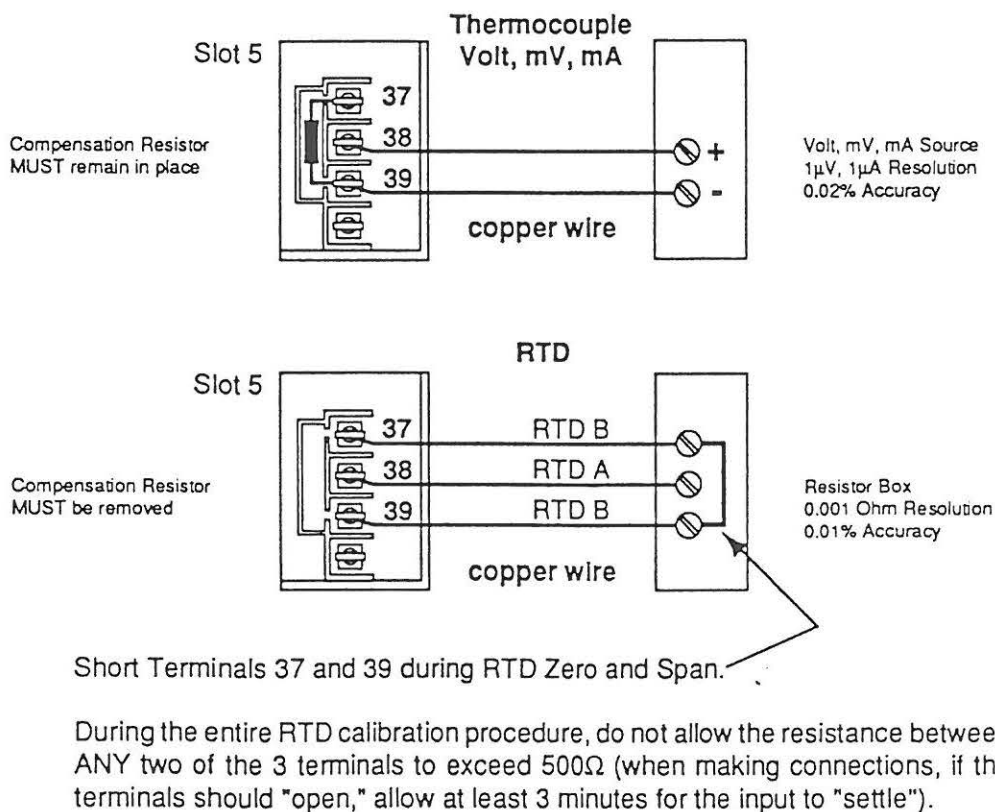


Figure 8.2 Calibration Connections (Zero & Span)

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEC

LP

CEL

IN

OUT

ALR

CAL

DIAG

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Calibration (continued)

Display	Key	Description																		
		Press the Function key to bring up the Slot 5 Input Signal Low screen.																		
 	 	8.7.1 Slot 5 Input Signal Low Attach the proper source (or resistor) to Terminals 38 and 39 (Terminal 38 is plus and Terminal 39 is minus for thermocouple, volt, millivolt and milliamp; the same terminals are used for RTD calibration). Adjust the source/resistance according to the following Table. <table><tr><th colspan="6">Input Type</th></tr><tr><th>Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)</th><th>Thermocouples (R, S, B)</th><th>Millivolts</th><th>Volts</th><th>Milliamps</th><th>RTDs</th></tr><tr><td>0.000 mV</td><td>0.000 mV</td><td>0.000 mV</td><td>0.000 V</td><td>0.000 mA</td><td>000.000 Ω</td></tr></table> Note that calibrating thermocouple inputs requires a low and high signal for each of the two thermocouple groups (pick one thermocouple type from each group). Once the source is properly set, press the Auto/Manual key. The controller will display the message "Cal busy" and begin the low end calibration procedure. Once the "Cal busy" message disappears, press the Function key to bring up the Slot 5 Signal High screen.	Input Type						Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs	0.000 mV	0.000 mV	0.000 mV	0.000 V	0.000 mA	000.000 Ω
Input Type																				
Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs															
0.000 mV	0.000 mV	0.000 mV	0.000 V	0.000 mA	000.000 Ω															
 	 	8.7.2 Slot 5 Input Signal High Adjust the source/resistance according to the following Table. <table><tr><th colspan="6">Input Type</th></tr><tr><th>Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)</th><th>Thermocouples (R, S, B)</th><th>Millivolts</th><th>Volts</th><th>Milliamps</th><th>RTDs</th></tr><tr><td>100.000 mV</td><td>21.000 mV</td><td>100.000 mV</td><td>10.000 V</td><td>20.000 mA</td><td>500.000 Ω</td></tr></table> Note that calibrating thermocouple inputs requires a low and high signal for each of the two thermocouple groups (pick one thermocouple type from each group). Once the source is properly set, press the Auto/Manual key. The controller will display the message "Cal busy" and begin the high end calibration procedure. The "Cal busy" message will be replaced by either a "Cal good" or "Cal bad" message. If the "Cal bad" message appears, press the Function key to return to the Signal High screen, then press the Setpoint Select key to back up to the Signal Low screen. Check connections and signal levels and repeat the Input Signal Low and Input Signal High calibration. If the "Cal good" message appears, press the Function key to bring up the Slot 5 Input Signal High screen, then press the Function key again to bring up the Slot 5 Compensation Low screen.	Input Type						Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs	100.000 mV	21.000 mV	100.000 mV	10.000 V	20.000 mA	500.000 Ω
Input Type																				
Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs															
100.000 mV	21.000 mV	100.000 mV	10.000 V	20.000 mA	500.000 Ω															

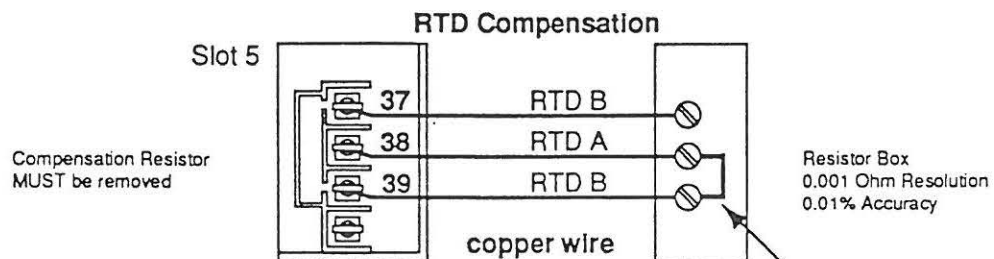
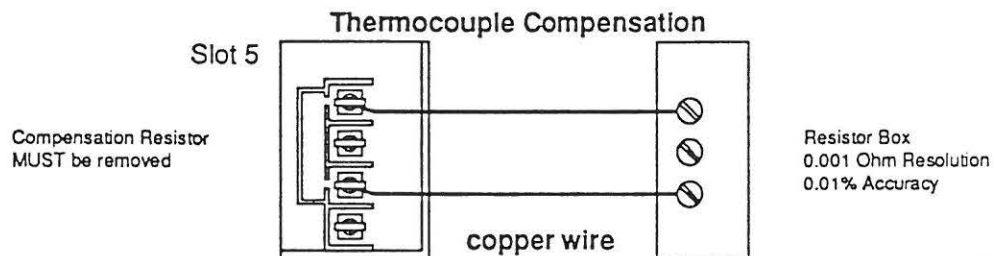
Configuration							
conf	Security	Loop	Control	Input	Output	Alarm	Calibration
5Ee	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Calibration (continued)

Display	Key	Description																		
 Thermocouples 500 RTDs 0 Volts, Millivolts, Current (Not Required) --- 	 	8.7.3 Slot 5 Compensation Low Attach the precision resistance box to Terminals 37 and 39 as shown in Figure 8.3 below. Adjust the resistance according to the following Table. <table><tr><th colspan="6">Input Type</th></tr><tr><th>Thermocouples (K, J, E, PL-II, C, N, NI/NI Mo, T)</th><th>Thermocouples (R, S, B)</th><th>Millivolts</th><th>Volts</th><th>Milliamps</th><th>RTDs</th></tr><tr><td>500.000 Ω</td><td>500.000 Ω</td><td colspan="3">Compensation not required</td><td>000.000 Ω</td></tr></table> Note that calibrating thermocouple inputs requires a compensation low and high signal for each of the two thermocouple groups (pick one thermocouple type from each group). Once the source is set, press the Auto/Manual key. The controller will display the message "Cal busy" and begin the low end compensation procedure. Once the "Cal busy" message disappears, press the Function key to bring up the Slot 5 Compensation High screen.	Input Type						Thermocouples (K, J, E, PL-II, C, N, NI/NI Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs	500.000 Ω	500.000 Ω	Compensation not required			000.000 Ω
Input Type																				
Thermocouples (K, J, E, PL-II, C, N, NI/NI Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs															
500.000 Ω	500.000 Ω	Compensation not required			000.000 Ω															

Connect to Terminals as shown below for Slot 5 Compensation Low and Slot 5 Compensation High.



Short Terminals 38 and 39 during RTD Compensation Calibration.

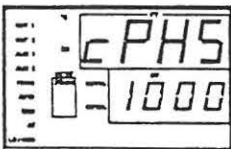
During the entire RTD calibration procedure, do not allow the resistance between ANY two of the 3 terminals to exceed 500 Ω (when making connections, if the terminals should "open," allow at least 3 minutes for the input to "settle").

Figure 8.3 Calibration Connections (Cold Junction Compensation)

Configuration							
conf	Security	Loop	Control	Input	Output	Alarm	Calibration Diagnostics
	SEC	LP	CEL	in	out	ALr	cAL d:R9

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

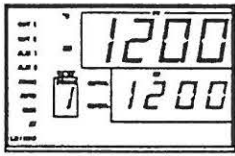
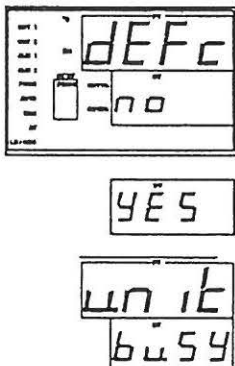
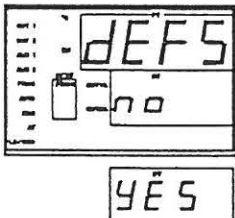
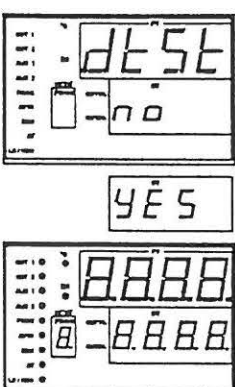
Calibration (continued)

Display	Key	Description																		
 Thermocouples (All) 1000 RTDs 500 Volts, Millivolts, Current (Not Required) ---	 	8.7.4 Slot 5 Compensation High Adjust the resistance according to the following Table. <table><thead><tr><th colspan="6">Input Type</th></tr><tr><th>Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)</th><th>Thermocouples (R, S, B)</th><th>Millivolts</th><th>Volts</th><th>Milliamps</th><th>RTDs</th></tr></thead><tbody><tr><td>1000.000 Ω</td><td>1000.000 Ω</td><td colspan="3">Compensation not required</td><td>500.000 Ω</td></tr></tbody></table> Note that calibrating thermocouple inputs requires a compensation low and high signal for each of the two thermocouple groups (pick one thermocouple type from each group). Once the source is set, press the Auto/Manual key. The controller will display the message "Cal busy" and begin the high end compensation procedure. The "Cal busy" message will be replaced by either a "Cal good" or "Cal bad" message. If the "Cal bad" message appears, press the Function key to return to the Compensation High screen, then press the Setpoint Select key to back up to the Compensation Low screen. Check connections and signal levels and repeat the Compensation Low and Compensation High calibration. If the "Cal good" message appears, press the Function key to bring up the Slot 5 Compensation High screen, then press the Function key again to bring up the Calibration Header screen.	Input Type						Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs	1000.000 Ω	1000.000 Ω	Compensation not required			500.000 Ω
Input Type																				
Thermocouples (K, J, E, PL-II, C, N, Ni/Ni Mo, T)	Thermocouples (R, S, B)	Millivolts	Volts	Milliamps	RTDs															
1000.000 Ω	1000.000 Ω	Compensation not required			500.000 Ω															
		<i>Repeat the entire calibration procedure for each of the input types included with the controller (2 thermocouple, millivolt, Volt, milliamp, and the optional RTD).</i>																		
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.																		

Configuration							
conf	Security	Loop	Control	Input	Output	Alarm	Calibration
	SEC	LP	CEL	in	out	ALr	CAL
							Diagnostics
							d:AG

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

8.8 Diagnostics

Display	Key	Description
		From the Operating mode, press and hold (for 4 seconds) the Setup key. Press the Setup key repeatedly until the Diagnostics Configuration Header screen appears.
		Diagnostics configuration is used to load a "default" configuration, or "default" setpoints, perform a display test, or perform a switch (key) test. Press the Function key to bring up the Load Default Configuration screen.
	  	8.8.1 Load Default Configuration The Load Default Configuration display is used to set EVERY configuration AND setup parameter to the default values listed in the Default Configuration Table and the Default Setup Table (see Tables and 8.3). There is no way of recovering previous values once this action is performed. There is also no way of knowing whether the default values will be valid for the process in question. Check the Default Configuration Table and the Default Setup Table before performing a Load Default Configuration and check the controller thoroughly after performing a Load Default Configuration. A "Unit Busy" screen will appear while the controller reconfigures. Press the Function key to bring up the Load Default Setpoints screen.
	  	8.8.2 Load Default Setpoints The Load Default Setpoints display is used to set three specific groups of setup parameters to the default values listed in the Default Setup Table (see Table 8.2 — they are marked with a cross †). There is no way of recovering previous setpoints once this action is performed. There is also no way of knowing whether the default setpoints will be valid for the process in question. Check the Setup Table before performing a Load Default Setpoints and check the controller thoroughly after performing a Load Default Setpoints. Press the Function key to bring up the Display Test screen.
	  	8.8.3 Display Test The Display Test screen is used to check that the individual display elements are working properly. If a display test is performed, every LED on the display will flash on and off for a five second period. Examine the display carefully for non-functioning segments or annunciators (repeat the test if necessary). Press the Function key to bring up the Switch Test screen.

Configuration

conf

Security

Loop

Control

Input

Output

Alarm

Calibration

Diagnostics

SEC

LP

CEL

in

out

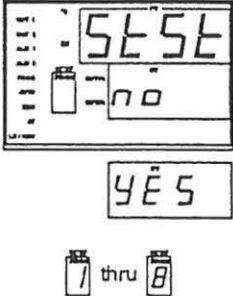
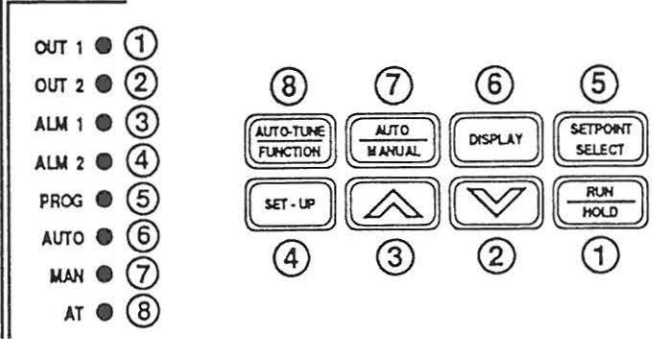
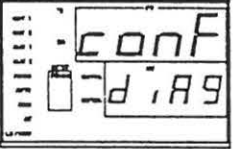
ALr

CAL

diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

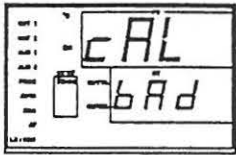
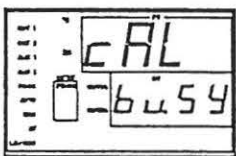
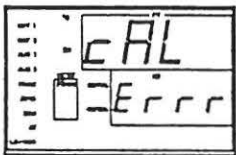
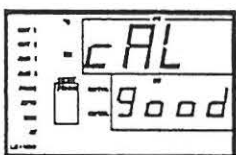
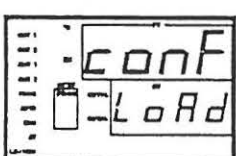
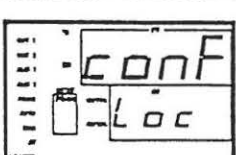
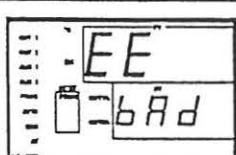
Diagnostics (continued)

Display	Key	Description
		8.8.4 Switch Test The Switch Test screen is used to check that the keypad keys are working properly. If a switch test is performed, pressing each particular key will cause a number from 1 to 8 to appear in the Set# display. A specific annunciator LED will also light. The switch test times out after fifteen seconds without a key press.  Press the Function key to bring up the Diagnostics Configuration Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Configuration mode (or press the Run/Hold key to go backwards through the Configuration mode). Note that there is no timeout from the Configuration mode – the Display key must be pressed in order to return to the Operating mode.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEc	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

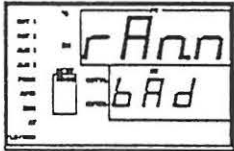
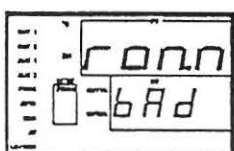
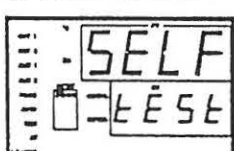
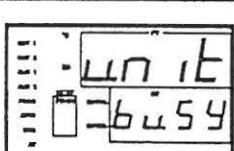
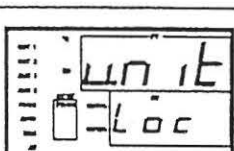
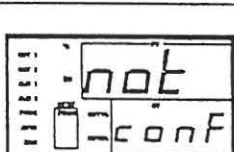
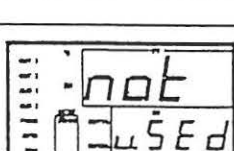
8.9 Vector Screens

Display	Key	Description
		There are three types of Vector screens used to communicate additional information to the user: Acknowledge, Message, and Static. They appear as the result of a variety of keystrokes or actions. The screens are listed here in alphabetical order. If one of these screens does appear, follow the directions given for that particular screen.
		This is an Acknowledge Vector screen which indicates that this portion of the calibration procedure was not successful. Press the Function key to acknowledge, then press the Setpoint Select key to return to the beginning of the procedure. Carefully check connections and signal levels and repeat this portion of the procedure.
		This is a Message Vector screen which appears momentarily during the calibration procedure. The controller is performing internal calculations. No action is necessary.
		This is a Message Vector screen which appears momentarily during calibration if an attempt is made to perform a part of the procedure out of sequence (e.g., performing the Input Signal High sequence before the Input Signal Low sequence). Step back to the proper screen and continue the procedure in sequence.
		This is an Acknowledge Vector screen which indicates that this portion of the calibration procedure was successful. Press the Function key to acknowledge, then press the Function key a second time to bring up the next portion of the calibration procedure.
		This is an Acknowledge Vector screen which indicates that the controller has detected a configuration conflict during powerup. Press any key to acknowledge. The controller will make three attempts to load the default configuration. If, after three attempts, the problem is not corrected, the "EE bad" vector screen will appear (see below).
		This is a Message Vector screen which appears if an attempt is made to use or alter a function which, though configured, already has a valid setting (most likely caused by contention between keypad and contact inputs. A contact input setting has priority over keypad changes. Check Input Configuration as well as the actual contact inputs.
		This is an Acknowledge Vector screen which indicates that the EEPROM Write function has detected a bad memory cell. Press any key to acknowledge. The controller will continue to function, but whichever items were bad have NOT been updated. Those items which were bad will return to their last saved setting.

Configuration								
conf	Security	Loop	Control	Input	Output	Alarm	Calibration	Diagnostics
	SEC	LP	CEL	in	out	ALr	CAL	diag

Note that all annunciator LEDs turn off; alarm outputs turn off; and control outputs go to 0% demand (analog outputs can still have a signal present at the terminals).

Vector Screens (continued)

Display	Key	Description
		This is a Static Vector screen which indicates the controller has determined that its RAM chip is bad. The controller is locked on this screen and requires servicing. Contact a service rep or the factory.
		This is a Message Vector screen which appears if an attempt is made to change a "read only" screen. In most cases, this indicates that what appears is related to a hardware function and cannot be changed from the keyboard. An exception to this is the Input Hardware Type (Slot 5) which is a "read only" screen in Setup, but can be changed in Configuration.
		This is a Static Vector screen which indicates the controller has determined that its ROM chip is bad. The controller is locked on this screen and requires servicing. Contact a service rep or the factory.
		This is a Message Vector screen which appears at powerup while the controller performs its internal self test. No action is necessary.
		This is a Message Vector screen which appears momentarily when changes which require internal calculations are made to the configuration (loading the default configuration or changing the sensor type). No action is necessary.
		This is a Message Vector screen which appears if an attempt is made to perform some keyboard action not allowed by the present security (either hardware or software). Go to Security Setup to change the software security level. Refer to Hardware Security for instructions on setting the (optional) hardware security switch.
		This is a Message Vector screen which appears if an attempt is made to use a function which is not configured (setpoint select, auto/manual or autotuning). See Loop Setup to enable both the Setpoint Select key and the Auto/Manual key (the Auto/Manual Select option must be present in order to make that particular selection). Go to AT Setup to enable autotuning (at least one control algorithm must be set to Pid or Pd-r in order for AT Setup to appear).
		This is a Message Vector screen which appears if an attempt is made to use a function which is configured, but is not actually present in the controller (e.g., Auto/Manual Select or Run/Hold). If the function is really required, contact a sales rep or the factory about either upgrading or replacing the controller.

Security		Tuning Set 1 (continued)	
\$	Security Level None	Δ †	Cycle Time 1 30
\$	Password None	Δ †	Spread 1 0
		Δ †	Proportional Band 2 20.0
System		Δ †	Load Line 2 0
	Software Version/Revision (as installed)	Δ †	Reset (Integral) 2 200
		Δ †	Rate (Derivative) 2 50
Loop		Δ †	Cycle Time 2 30
	Setpoint Source Setpoint 1	Δ †	Spread 2 0
	Setpoint Select Key Enable Yes		
Δ	Auto/Manual Key Enable No	Tuning Set 2	
Δ	Powerup Type Automatic	†	Setpoint 2 0
Δ	Setpoint Ramp Enable No	Δ †	Proportional Band 1 10.0
Δ	Ramp Rate Up 9999	Δ †	Load Line 1 50
Δ	Ramp Rate Down 9999	Δ †	Reset (Integral) 1 200
		Δ †	Rate (Derivative) 1 50
Control		Δ †	Cycle Time 1 30
	Setpoint Low Limit Input Scale Low	Δ †	Spread 1 0
	Setpoint High Limit Input Scale High	Δ †	Proportional Band 2 20.0
Δ	Hysteresis Out 1 1	Δ †	Load Line 2 0
Δ	Minimum Power Out 1 0	Δ †	Reset (Integral) 2 200
Δ	Maximum Power Out 1 100	Δ †	Rate (Derivative) 2 50
Δ	Slew Rate Filter Out 1 100	Δ †	Cycle Time 2 30
Δ	Hysteresis Out 2 1	Δ †	Spread 2 0
Δ	Minimum Power Out 2 0		
Δ	Maximum Power Out 2 100	Input	
Δ	Slew Rate Filter Out 2 100	Slot 5 Hardware Type (see Model Number)	
Δ	Manual Percent Preset 0	Slot 5 Eng. Units (see Model Number)	
		Slot 5 Sensor Correct 0	
Autotune		Slot 5 Filter Window 0	
Δ	AutoTune Type None	Slot 5 Decimal Location 0	
Δ	Autotune Response 1.0		
Δ	Adaptive Tune Enable No	Alarm	
		†	Alarm 1 Ack No
Tuning Set 1		†	Alarm 1 Setpoint 0
†	Setpoint 1 0	†	Alarm 1 Hysteresis 1
Δ †	Proportional Band 1 10.0	†	Alarm 2 Ack No
Δ †	Load Line 1 50	†	Alarm 2 Setpoint 0
Δ †	Reset (Integral) 1 200	†	Alarm 2 Hysteresis 1
Δ †	Rate (Derivative) 1 50	†	Loop Break 0

Table 8.2 Setup Defaults

Note that the controller will be shipped "as ordered" by model number. "Default" and "As Shipped" are the same, but are model number dependent as noted by items labeled "see Model Number."

\$ Dependent on Security Type

Δ Dependent on "Algorithm."

† Default Setpoints.

Security		Output	
	Security Type	None	√ Slot 1 Hardware Type (see Model Number)
	Set Code 1	1	√ Slot 1 Assignment (see Model Number)
	Set Code 2	2	£ Slot 1 Output Signal Low (see Model Number)
	Set Code 3	3	£ Slot 1 Output Signal High (see Model Number)
	Set Code 4	4	√ Slot 2 Hardware Type (see Model Number)
	Set Code 5	5	√ Slot 2 Assignment (see Model Number)
Loop		£	Slot 2 Output Signal Low (see Model Number)
	Tuning Set Limit	1-2	√ Slot 3 Hardware Type (see Model Number)
Σ	Sensor Break (Burn) Up (outs off; alarms upscale)		√ Slot 3 Assignment (see Model Number)
¥	Auto Compensation Type	Process	√ Slot 4 Hardware Type (see Model Number)
Δ	Auto/Man. Transfer Type	Process	√ Slot 4 Assignment (see Model Number)
Control		Alarm	
	Algorithm 1	PID	Alarm 1 Type (see Model Number)
Δ	Control Action 1	Reverse	Alarm 1 Standby Time 0
¶	PID Type 1	Linear	Alarm 1 Latch Enable No
	Algorithm 2	None	Alarm 2 Type (see Model Number)
¶	PID Type 2	Linear	Alarm 2 Standby Time 0
Δ	Safety Percent Out	0	Alarm 2 Latch Enable No
Input		Calibration	
	Slot 5 Hdwre Type	Universal	Slot 5 Signal Low (see calibration)
	Slot 5 Sensor Type	(see Model Number)	Slot 5 Signal High (see calibration)
	Slot 5 Assignment	Process Input 1	Slot 5 Compensation Low (see calibration)
	Slot 5 Input Scale Low	(see Model Number)	Slot 5 Compensation High (see calibration)
	Slot 5 Input Scale High	(see Model Number)	
Σ	Slot 5 Input Signal Low	(see Model Number)	Diagnostics
Σ	Slot 5 Input Signal High	(see Model Number)	
	Slot 6 Hdwre Type	None	
	Slot 7 Hdwre Type	(Contact In, see Mod. No.)	
	Slot 7 Contact 1 Definition	None	
	Slot 7 Contact 2 Definition	None	

Table 8.3 Configuration Defaults

Note that the controller will be shipped "as ordered" by model number. "Default" and "As Shipped" are the same, but are model number dependent as noted by items labeled "see Model Number."

Δ Dependent on "Algorithm."

¥ Dependent on "Sensor Break Mode."

¶ Dependent on "Control Action."

Σ Dependent on "Sensor Type."

£ Dependent on "Hardware Type."

√ Dependent on Model Number and hardware location. These items can be determined by studying both the Model Number and the Wiring Label (or they can be read directly from the Output Configuration – they are "read only" screens).

9. Controller Specifications

Control Modes

On/Off; Proportional; Proportional/Integral; Proportional/Integral/Derivative (all with Load Line); Proportional/Derivative with Manual Reset; None (for Indicator).

Proportional Band

0.1% to 200.0% of Input Scale (Input Low to High).

Integral (Reset)

0 to 3600 seconds in 1 second steps (0 indicates off).

Derivative (Rate)

0 to 2400 seconds in 1 second steps (0 indicates off).

Load Line

0% to 100% (of Demand) in 1% steps.

Cycle Time

1 to 120 seconds in 1 second steps (30 seconds minimum for relay outputs).

Powerup Modes

Automatic; Manual; or Previous (can be Automatic or Manual depending on the mode when powered down). Manual powers up with a preset manual percent out.

Output On/Off Hysteresis

0 to 10% of Input Scale (Input Low to High) in steps of the Input Scale (depending on the location of the user programmed decimal point).

Output Limits

Minimum Power (0 Percent Out) to Maximum Power (100 Percent Out)(105% for analog outputs).

Control Action

Single Output – Reverse (Heating); Direct (Cooling).

Dual Output – Reverse (Output 1 Reverse acting; Output 2 Direct acting). Direct (Output 1 Direct acting; Output 2 Reverse acting).

Response Time

300 milliseconds.

Setpoint Limits

Minimum (Setpoint Low) and maximum (Setpoint High) limits can be set anywhere within Input Scale (Scale Low to Scale High).

Setpoint Ramp

0.1 to 9999 units per minute depending on decimal point location (separate entry for ramp up and ramp down). Operational whenever setpoints change (from front of instrument or contact closure). On powerup, the process reading is used as the initial setpoint.

DC Inputs

Current	4 to 20	mADC	-1999 to 9999
Voltage	0 to 5	VDC	-1999 to 9999
Voltage	1 to 5	VDC	-1999 to 9999
Voltage	0 to 10	VDC	-1999 to 9999
Voltage	0 to 100	mVDC	-1999 to 9999
Voltage	-10 to 10	mVDC	-1999 to 9999
Voltage	0 to 10	mVDC	-1999 to 9999

DC input levels can be assigned limits anywhere within a range of -10 to 100 mVDC; 0 to 20 mA; or 0 to 10 VDC.

Input Impedance

Millivolt, Volt, Thermocouple: 10 Megohm minimum.

Current: 250 ohms nominal.

Thermocouple and RTD Inputs

Type K,	-100 °F to 2400 °F;	-75 °C to 1320 °C
Type J,	-100 °F to 1600 °F;	-75 °C to 875 °C
Type E,	-100 °F to 1600 °F;	-75 °C to 875 °C
Type R,	0 °F to 3100 °F;	-20 °C to 1705 °C
Type S,	0 °F to 3100 °F;	-20 °C to 1705 °C
Type B,	100 °F to 3100 °F;	37 °C to 1817 °C
PL-II,	0 °F to 2500 °F;	-20 °C to 1375 °C
Type C,	0 °F to 4200 °F;	-20 °C to 2320 °C
Type N,	-100 °F to 2400 °F;	-75 °C to 1320 °C
Ni/Ni Mo	32 °F to 2500 °F;	0 °C to 1371 °C
Type T,	-350 °F to 700 °F;	-215 °C to 375 °C
RTD 385	-199.9 °F to 999.9 °F;	-199.9 °C to 850.0 °C

Accuracy not guaranteed for Type B below 200°C or for Types R and S below 100°C.

RTD

3-wire Platinum, 100 Ω (0.00385 $\Omega/\Omega/^\circ\text{C}$), per IEC 751 and DIN 43760.

Input Lead Resistance

200 Ω maximum (any control input).

Contact Closure Inputs

2 contacts, 1.5 mA max. current ; 200 Ω max. resistance (leads and contacts); 500 msec. minimum closure.

Input Protection

Common Mode Rejection (Thermocouple & RTD only)
Common mode voltages from 0 to 240 VAC will not shift the control operating point more than 0.1% of span.

Common Mode Rejection (Analog Inputs)

Common mode voltages from -1 to 10 VDC will not shift the control operating point more than 0.5% of span.

Series Mode Rejection

60 db at 50 or 60 Hz for all input signals from 0 to 250 mVAC RMS.

Sensor Break Protection (Burn Mode)

On – Outputs go to the "on" condition (maximum percent out demand for PID and "on" for on/off).

Off – Outputs go to the "off" condition (minimum percent out demand for PID and "off" for on/off) (as shipped).

Safe – Outputs go to the safety out percent demand specified by the user.

AutoComp – Output is determined by the autocomp type chosen. If the autocomp type is "manual percent," then the output will go to the preset manual percent output entered by the user. If the autocomp type is "process" and the control output demand is stable, then the output will freeze at the present process demand percent output. If the "steady state" conditions have not been met the output will go to the preset manual percent output entered by the user.

Input Isolation to Ground
500 VDC.

Accuracy
 $\pm 0.3\%$ of span typical (± 1 digit of display).

Input Resolution
Thermocouples – 0.1°C or $^\circ\text{F}$ (under 999 counts); 1°C or $^\circ\text{F}$ (over 999 counts).

RTDs – 0.1°C or $^\circ\text{F}$.

Analog – 0.02% of full scale span.

Control Outputs

Output 1 Relay – Form C, SPDT. NO, NC and Common contacts. 120/240 VAC, 2 Amp, resistive load; 200 VA inductive load.

Output 2 Relay – Form A, SPST. NO and Common contacts. 120/240 VAC, 2 Amp, resistive load; 200 VA inductive load.

Triac Output – 1.0 Amp continuous, 24 to 240 VAC, resistive, 8 Amp inrush. Minimum load 50 mA.

Non-Contact Voltage – On: 12 VDC; Off: 0.1 VDC or less, into 1K Ohm minimum load.

Current – 0 to 21 mA (shipped 4 to 20 mA), isolated, short circuit protected both leads to ground. 600 Ohm maximum load. 12 bit resolution for 0 to 20 mA. 0.2% accuracy at full scale at rated conditions.

Voltage – 0 to 10.5 VDC, isolated, short circuit protected at 30 mA both leads to ground. 1K Ohm minimum load. 12 bit resolution for 0 to 10 VDC. 0.2% accuracy at full scale at rated conditions.

Alarm Outputs

Up to 2 alarm relays available (see model number for limitations). Form A, SPST. NO and Common contacts are brought out to the rear terminals as standard. NC operation is jumper selectable. 120/240 VAC, 2 Amp, resistive load; 200 VA inductive load.

Displays

Process Value – 4 digit, 14.2mm (0.56 in.), 7 segment orange LEDs, from -1999 to 9999.

Set Value – 4 digit, 10.2mm (0.40 in.), 7 segment green LEDs, from -1999 to 9999.

SET#/PROG (Setpoint Number/Program) – 1 digit, 7.6mm (0.30 in.), 7 segment green LED, from 0 to 9. Indicates setpoint (and tuning set) number. Also used to indicate ramping setpoint.

Status Annunciators

OUT 1 (green LED); OUT 2 (green LED)
Lit when the output is on. For analog DC outputs, LED will turn off when demand equals minimum power.

ALM 1 (red LED); ALM 2 (red LED)
Flashes when alarm is on. A steadily lit alarm LED means the alarm has been acknowledged. On a non-latching alarm, the LED turns off when the alarm condition clears. On a latching alarm, the LED continues to flash when the alarm condition clears until acknowledged and then the LED turns off.

AUTO (green LED)
Lit when controller is in the automatic control mode.

MAN (yellow LED)
Lit when controller is in the manual control mode (flashes if manual control mode has been initiated by contact input function).

AT (yellow LED)
Lit when controller is performing autotuning. Flashes if AT fails (press the AT button to clear the flashing LED).

LB/HBO (red LED)
Flashes when loop break alarm exists. Off when alarm condition clears. Loop break can be programmed to one of the alarm outputs.

$^\circ\text{C}$ (green LED)
Lit when Celsius (Degrees C) is displayed.

RS (green LED)
Lit when Remote Setpoint is in use (reserved for future).

OUT1% (green LED dash)
The upper bar of the left-most 7 segment display is lit when the SV display is showing percent out for output 1.

OUT2% (green LED dash)

The lower bar of the left-most 7 segment display is lit when the SV display is showing percent out for output 2.

Security

Programmable 4 digit pass code.

Pass Code Levels

Level 1 Operating mode screens can be reached, but data cannot be changed.

Level 2 Same as Level 1, except setpoints (or percent out in manual mode) can be changed.

Level 3 Same as Level 2, except setpoint select, autotune and auto/manual can be used.

Level 4 Same as Level 3, except Setup can be changed.

Level 5 Same as Level 4, except Configuration data can be changed.

Hardware Lock

Internal switch: "Total" locks entire keyboard; "Partial" allows setpoint changes only.

Loop Break Function

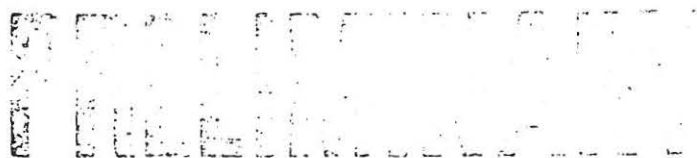
Settable from 0 to 10 minutes (0 = Off). If a maximum percent out demand signal is present and no progress is made toward setpoint within the time setting, the LB LED will begin flashing and the output will change to the preset percent out. If an alarm output has been assigned to the function, the alarm will energize.

Indicator

The controller can be ordered as an indicator (without control outputs) or it can be configured in the field as an indicator by setting the control algorithms to "none." Resident control outputs become inactive. The Setting Value and the Set# display will be blank in the operate mode. Any currently configured process alarms will continue to operate. Any currently configured deviation alarms will cease to exist (since there are no control setpoints from which to deviate). Any currently configured loop break alarms will cease to exist (since there are no control loops to be broken).

Manual Station

The controller can be setup as a manual station only (without automatic control).



10. Controller Model Number

MODEL 1 0 Q - 0 - - -
Field No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Field 3. CONTROLLER SIZE

Q - Quarter DIN

Field 4. CONTROL OUTPUT 1

V - Indicator (No Output)

1 - Relay (Form C)

2 - Pulse Non-Contact Voltage for SSR (12 VDC)

3 - Current (4-20 mA)

4 - Voltage (0-10 VDC)

T - Triac (24-260 VAC, 1A)

Field 5. CONTROL OUTPUT 2*

0 - None

1 - Relay (Form A)

2 - Pulse Non-Contact Voltage for SSR (12 VDC)

3 - Current (4-20 mA)

4 - Voltage (0-10 VDC)

T - Triac (24-260 VAC, 1A)

*Control Output 2 is NOT available with a combination of Control Output 1 Form C Relay (Option 1) and Alarm 2.

Fields 6, 7. INPUT 1

Universal Input (field selectable) for TC, Current, Millivoltage and Voltage inputs. Ordering RTD input provides field selectable RTD, TC, Current, Millivoltage and Voltage inputs.

Thermocouple

(Decimal Point Programmable up to 1 digit)

KF - Type K, -100 °F to 2400 °F

KC - Type C, -75 °C to 1320 °C

JF - Type J, -100 °F to 1600 °F

JC - Type J, -75 °C to 875 °C

EF - Type E, -100 °F to 1600 °F

EC - Type E, -75 °C to 875 °C

RF - Type R, 0 °F to 3100 °F

RC - Type R, -20 °C to 1705 °C

SF - Type S, 0 °F to 3100 °F

SC - Type S, -20 °C to 1705 °C

BF - Type B, 100 °F to 3100 °F

BC - Type B, 37 °C to 1817 °C

PF - Type P, 0 °F to 2500 °F

PC - Type P, -20 °C to 1375 °C

CF - Type C, 0 °F to 4200 °F

CC - Type C, -20 °C to 2320 °C

NF - Type N, -100 °F to 2400 °F

NC - Type N, -75 °C to 1320 °C

MF - Ni/Ni Mo, 32 °F to 2500 °F

MC - Ni/Ni Mo, 0 °C to 1371 °C

TF - Type T, -350 °F to 700 °F*

TC - Type T, -215 °C to 375 °C*

*Decimal Point is NOT Programmable with Type T

Current and Voltage

(Decimal Point Programmable up to 3 digits)

C1 - Current 4 to 20 mADC -1999 to 9999

V1 - Voltage 0 to 5 VDC -1999 to 9999

V2 - Voltage 1 to 5 VDC -1999 to 9999

V3 - Voltage 0 to 10 VDC -1999 to 9999

V4 - Voltage 0 to 100 mVDC -1999 to 9999

V5 - Voltage -10 to 10 mVDC -1999 to 9999

V6 - Voltage 0 to 10 mVDC -1999 to 9999

Fields 6, 7. INPUT 1 (continued)

RTD

(Decimal Point Programmable up to 1 digit)

8F - PLT100 DIN (0.00385Ω/Ω°C) -199.9 °F to 999.9 °F

8C - PLT100 DIN (0.00385Ω/Ω°C) -199.9 °C to 850.0 °C

Field 9. ADVANCED OPTIONS

0 - None

1 - Auto/Manual

Field 10. CONTACT CLOSURES

0 - None

1 - Dual Contact Closure, programmable to Manual Select*, Second Local Setpoint and Tuning Constants, Toggle Output Action, Sample & Hold, Freeze Reset and Halt.

*Note that Auto/Manual option must be ordered for Manual Select.

Field 11. ALARM 2*

Form A Relay; shipped NO, field configurable to NO/NC; field configurable Standby and Latching function.

0 - None

1 - High Deviation

2 - Low Deviation

3 - Deviation Band (deenergized in the band)

4 - Deviation Range Band (energized in the band)

5 - Process High

6 - Process Low

B - Loop Break Relay

*Alarm 2 is NOT available with a combination of Control Output 1 Form C Relay (Option 1) and Control Output 2.

Field 12. POWER SUPPLY

0 - 85 to 264 VAC, 50/60 Hz

Field 13. ALARM 1

Form A Relay; shipped NO, field configurable to NO/NC if Form C Output 1 Relay is NOT ordered; field configurable Standby and Latching function.

0 - None

1 - High Deviation

2 - Low Deviation

3 - Deviation Band (deenergized in the band)

4 - Deviation Range Band (energized in the band)

5 - Process High

6 - Process Low

B - Loop Break Relay

Fields 14, 15. SPECIALS

00 - None

01 - Shipped without Housing (order Housing separately)

02 - Hardware Security Lock

11. How Autotuning Works

If autotuning has been selected, the controller will begin to execute autotuning on startup or when the Autotune key is pressed. The controller first calculates an "autotune start" setpoint using the following formula:

$$\text{AT Stpt} = (\text{Control Stpt}) - (15\% [\text{Scale High} - \text{Scale Low}])$$

The control outputs will be turned off in an attempt to reach the AT Setpoint. Tuning will not begin until (or unless) the process value falls below the AT Setpoint. If the process value does not fall below the AT Setpoint within 15 minutes, autotuning will time out and fail (and the AT light will start blinking).

Once the process value falls below the AT Setpoint, the controller will use a temporary set of tuning constants to determine the lag and slope of the load. Lag and slope are then used to calculate new tuning constants. Once the new tuning constants are calculated, the current Tuning Set (Tuning Set 1 or Tuning Set 2) is overwritten.

Using Autotuning

The following conditions must be met before autotuning can be used:

1. The controller must be in the automatic control mode (the "Auto" LED will be lit).
2. At least one algorithm must be set to PID or PD-r (see Control Configuration).
3. The control action for the PID or PD-r algorithm must be reverse (heat)(see Control Configuration).
4. The autotune type must be powerup (see AT Setup).

Once the controller meets these conditions, go to the Operating mode and use the Setpoint Select key to bring up the Tuning Set in which the autotuned constants are to be stored (observe the Set# display). Check Loop Setup if the Setpoint Select key does not function (it may be disabled). Remember that any tuning constants presently stored in the chosen Tuning Set will be overwritten once autotuning is complete. Make certain the proper control setpoint has been entered (in the Operating mode it will appear in the lower display).

Press the Autotune key or cycle power to the controller. The AT light will be steadily lit, indicating that tuning is occurring. The AT light will turn off once the autotune sequence is successful. A blinking AT light indicates that the process value did not fall below the AT Setpoint within the fifteen minutes allowed and autotuning has therefore failed. Check the control setpoint and input scale (see Input Configuration) to see if it is physically possible for the process value to reach the AT Setpoint. If possible, allow the process to cool and try again.

Autotuning can be stopped by pressing the Autotune key (the AT LED will turn off). Autotuning can be started either on power up or by pressing the AT key.

Once the autotune sequence is successful, the newly calculated tuning constants will overwrite the Tuning Set currently on display (Set#). If there is a cooling output (with a PID algorithm), the same reset and rate terms calculated for heating will be used, but the proportional band for the cooling output will be doubled.

Once tuning is complete, the autotune type should be changed to "none" (see AT Setup) or the next time the controller powers up, it will attempt to retune.

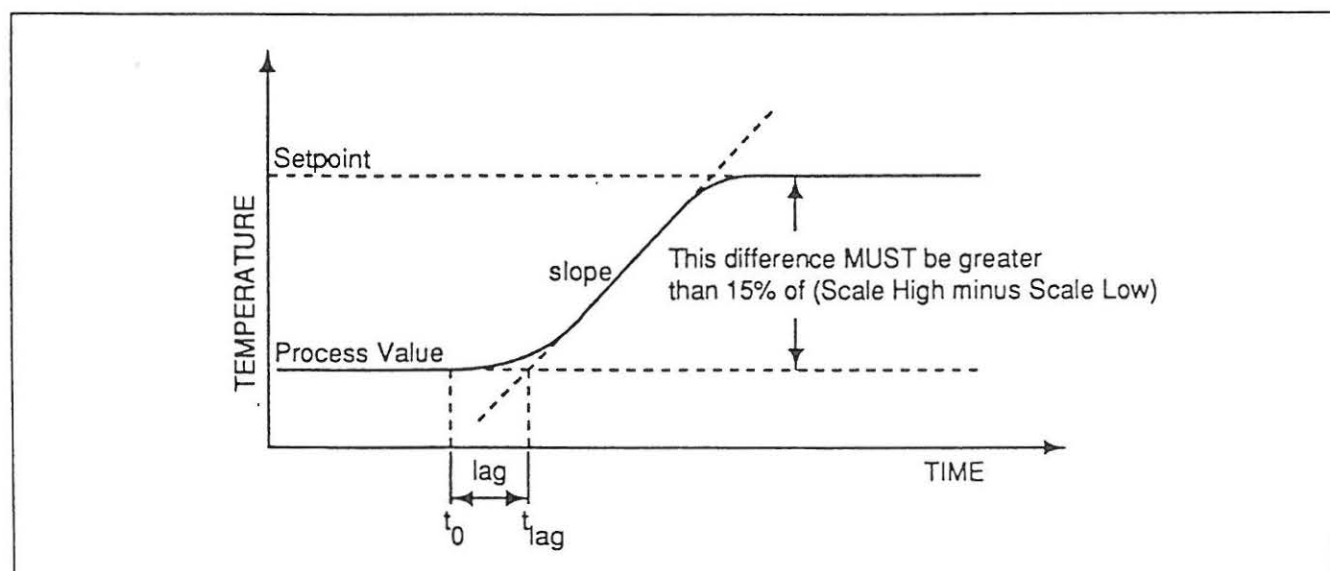


Figure 11.1 Autotuning Graph

12. How Adaptive Tuning Works

If adaptive tuning has been selected, the controller will continuously monitor the movement of the process value about setpoint. If this movement is determined to be a "valid" oscillation and the deviation is large enough, then the autotuning constants will be adjusted.

The controller must observe two periods of "valid" oscillation. Timers are used to verify that the two oscillations have roughly the same period. Deviation from setpoint is used to determine the amplitude of the oscillations. The controller then calculates a new "lag" (see autotuning) based on the period of oscillation.

New tuning constants are calculated based on this lag and the amount of accumulated reset (the proportional band is adjusted based on accumulated reset; Reset and Rate are adjusted based on lag).

Using Adaptive Tuning

The following conditions must be met before adaptive tuning can be used:

1. The controller must be in the automatic control mode (the "Auto" LED will be lit).

2. At least one algorithm must be set to PID or PD-r (see Control Configuration).

3. The control action for the PID or PD-r algorithm must be reverse (heat)(see Control Configuration).

4. Adaptive Tune Enable must be set to "yes" (see AT Setup).

As long as these conditions are met and the controller remains in the Operating mode, adaptive tuning will function. If autotuning is started, adaptive tuning will stop. Nothing on the display will indicate that adaptive tuning is executing.

Once the adaptive tuning routine is complete, the new tuning constants overwrite those in the currently used Tuning Set.

Adaptive tuning can be stopped by setting Adaptive Tune Enable to "no" (see AT Setup). Adaptive tuning can be left on continually to "fine tune" the tuning constants or it can be turned off once satisfactory tuning constants are found.

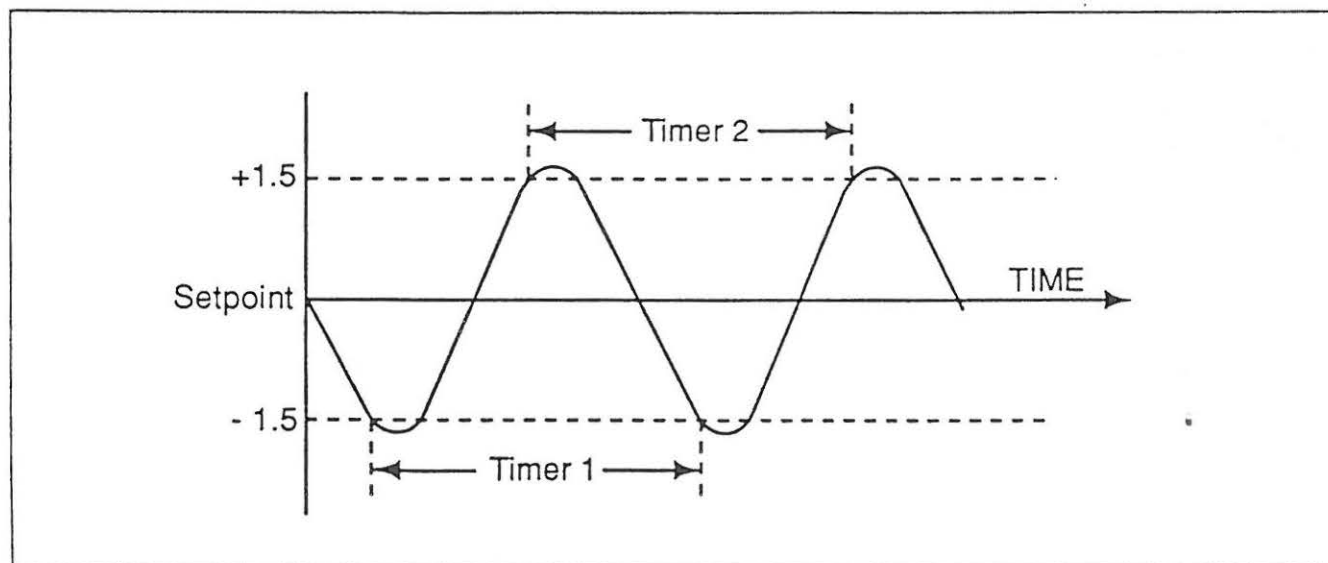


Figure 12.1 Adaptive Tuning Graph

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